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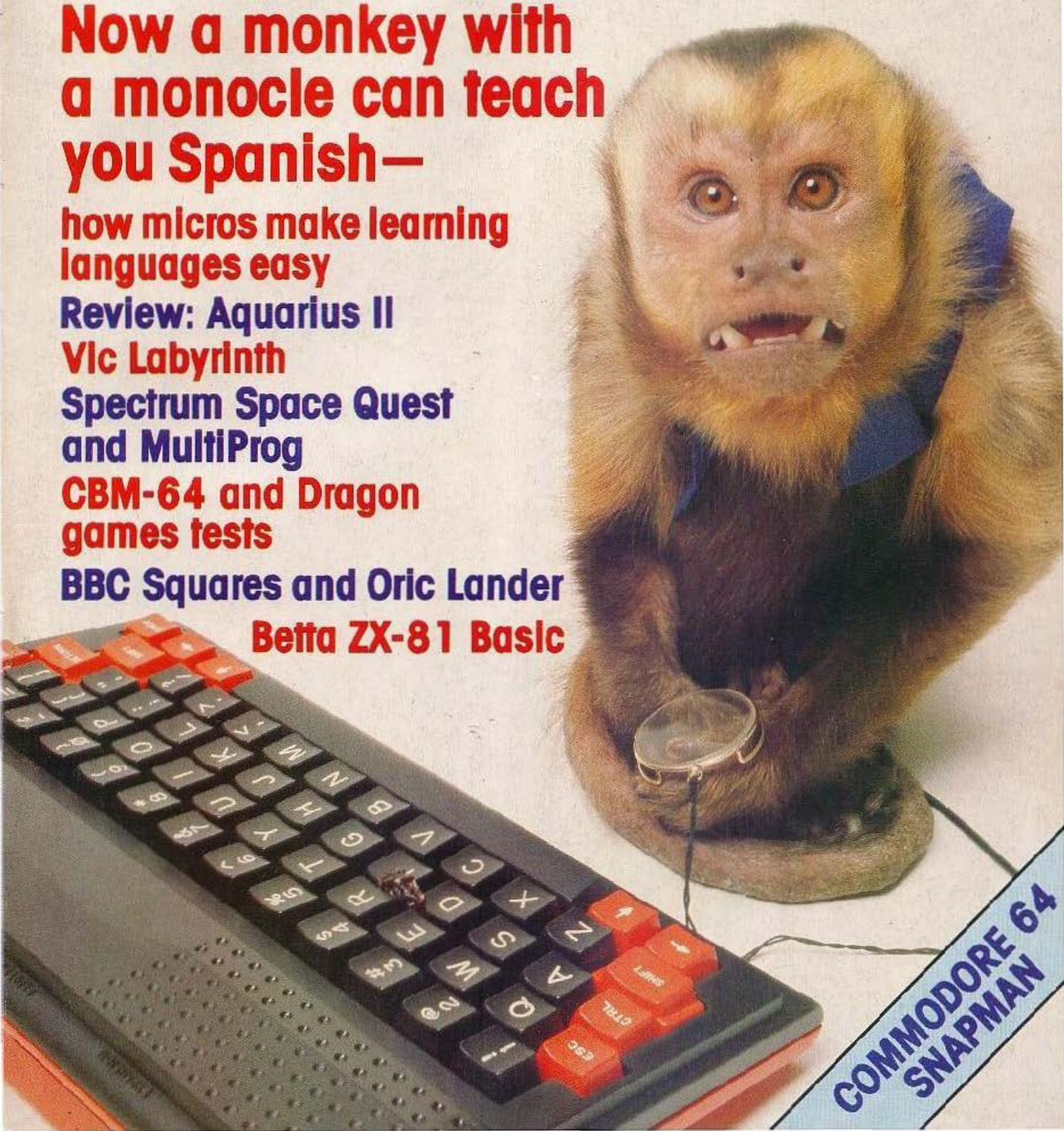

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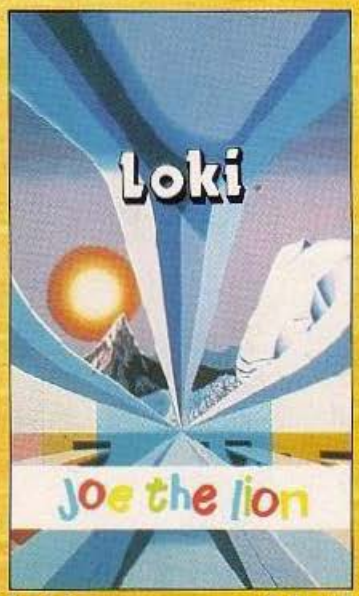

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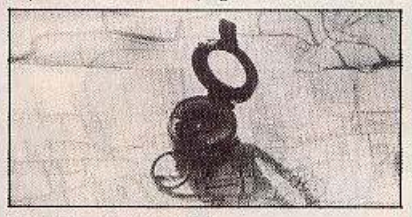
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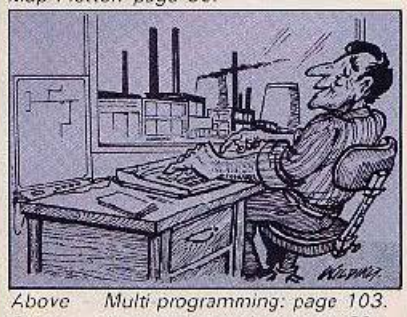
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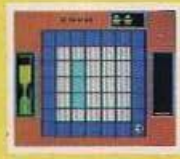

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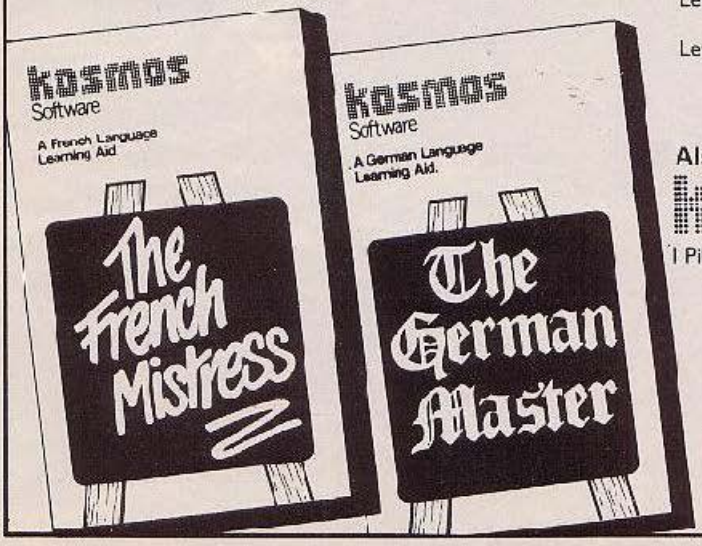

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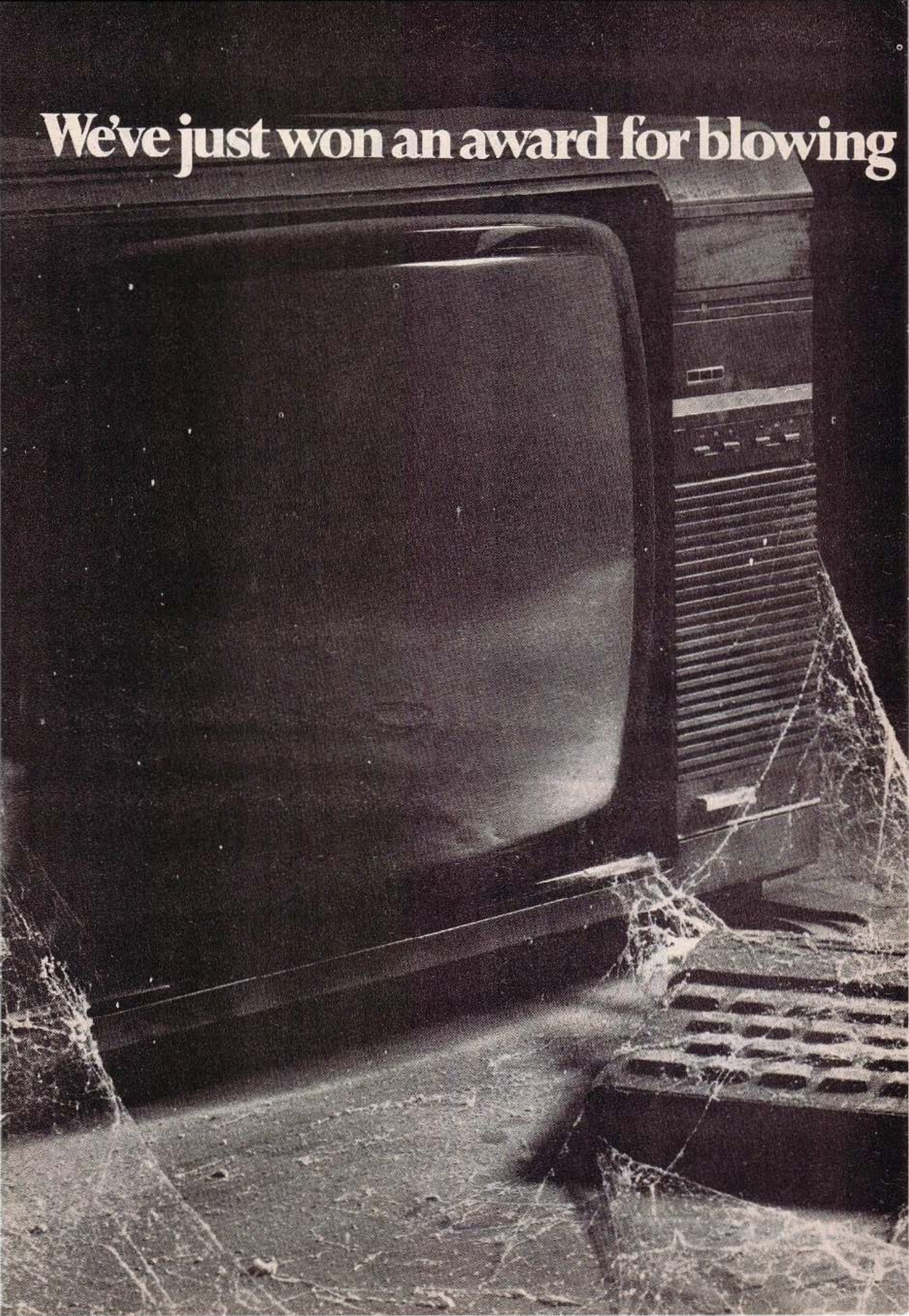
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Speed of max. data capture rate approx. 128k baud.
(8 lines of Teletext per frame.)
Height 70mm. Width 210mm. Depth 350mm. Weight 2kg.
Colour: BBC Computer cream.
Construction: Moulded top and bottom to match BBC computer profile. ABS injection moulded plastic.
Controls: Four tuning potentiometers on rear panel.
Mains on/off switch on rear panel.
Power in 240v, 50Hz, 15w.
Operating Temperature: 10° to 35°C.
Designed and manufactured to comply with BS415 Class 1 standard.

To: BBC Microcomputers, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.

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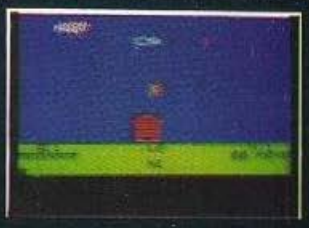

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The Birds and The Bees is an original animated cartoon-style game, introducing, for the first time on screen, Boris the Bee. Boris must collect as much nectar as possible, whilst avoiding various nasties like birds, wasps, centipedes and Venus fly traps. Smooth, fast machine-code action throughout, with sound effects, joystick option (most types) and speech option with the Currah Microspeech Unit.

Author: Adrian Sherwin with graphics by Matthew Smith (of Manic Miner fame)

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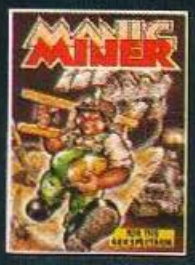

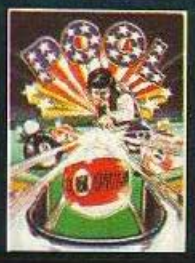

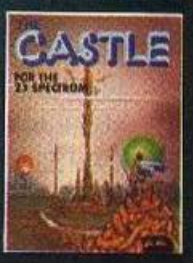

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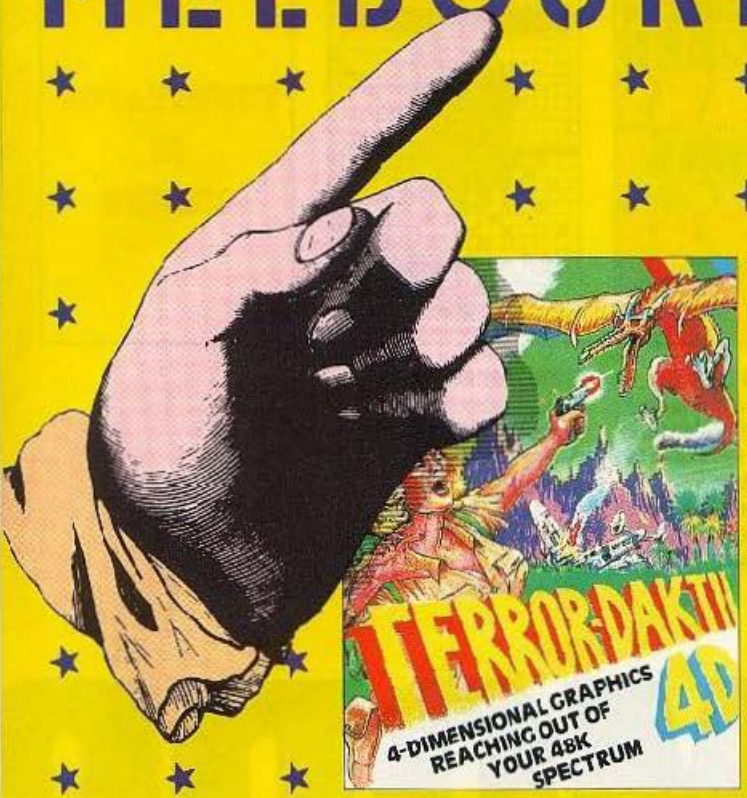

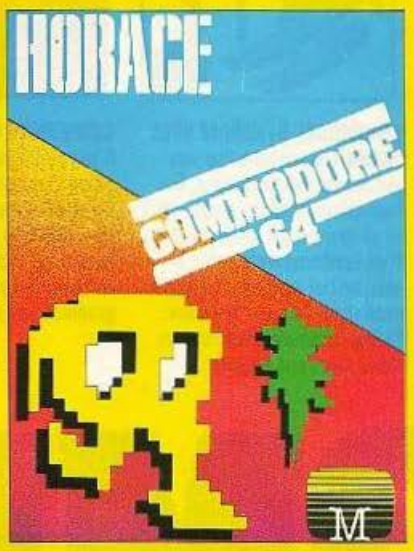

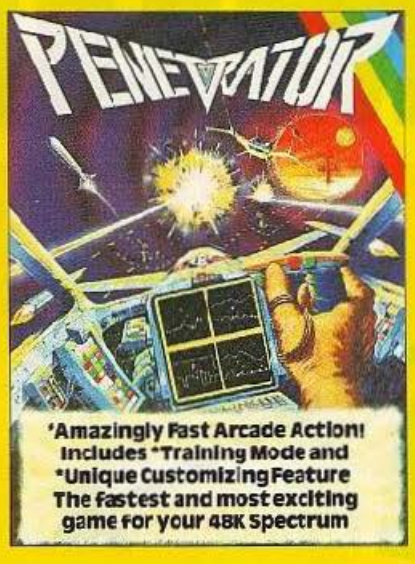

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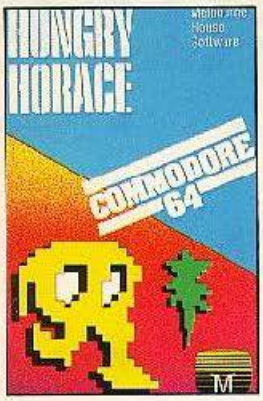
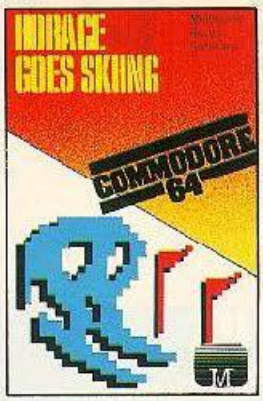
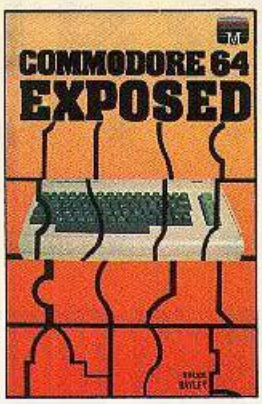


COMMODORE 64 HUNGRY HORACE Just when you thought computer games had nothing more to offer, here comes Horace for your Commodore 64. Hungry Horace creates havoc in the park as he picks the flowers, anroys the guards and steals their lunch.



COMMODORE 64 HORACE GOES SKIING The sequel to the very successful Hungry Horace. Our hero attempts winter sports. First of all he must get to the ski shop, then lumbered with a paid of skis, he has to dodge the traffic once again to reach the snow. Skiing is complete with slalom flags, trees and moguls!



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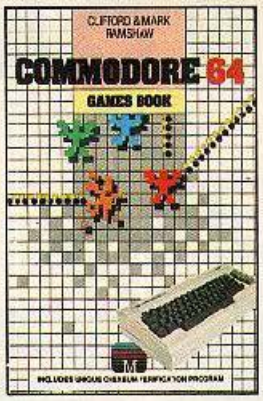

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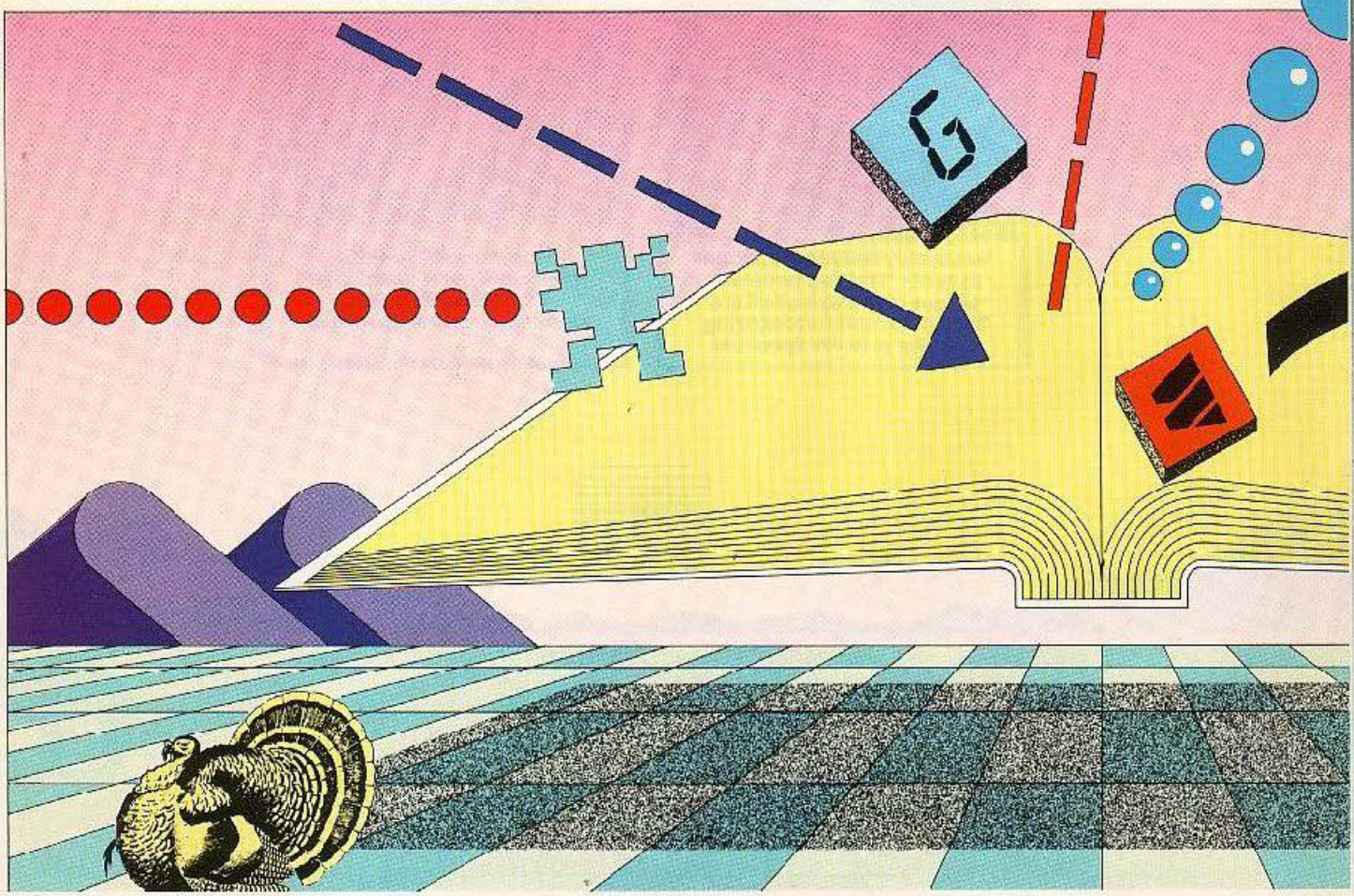

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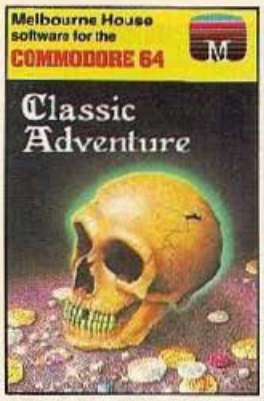

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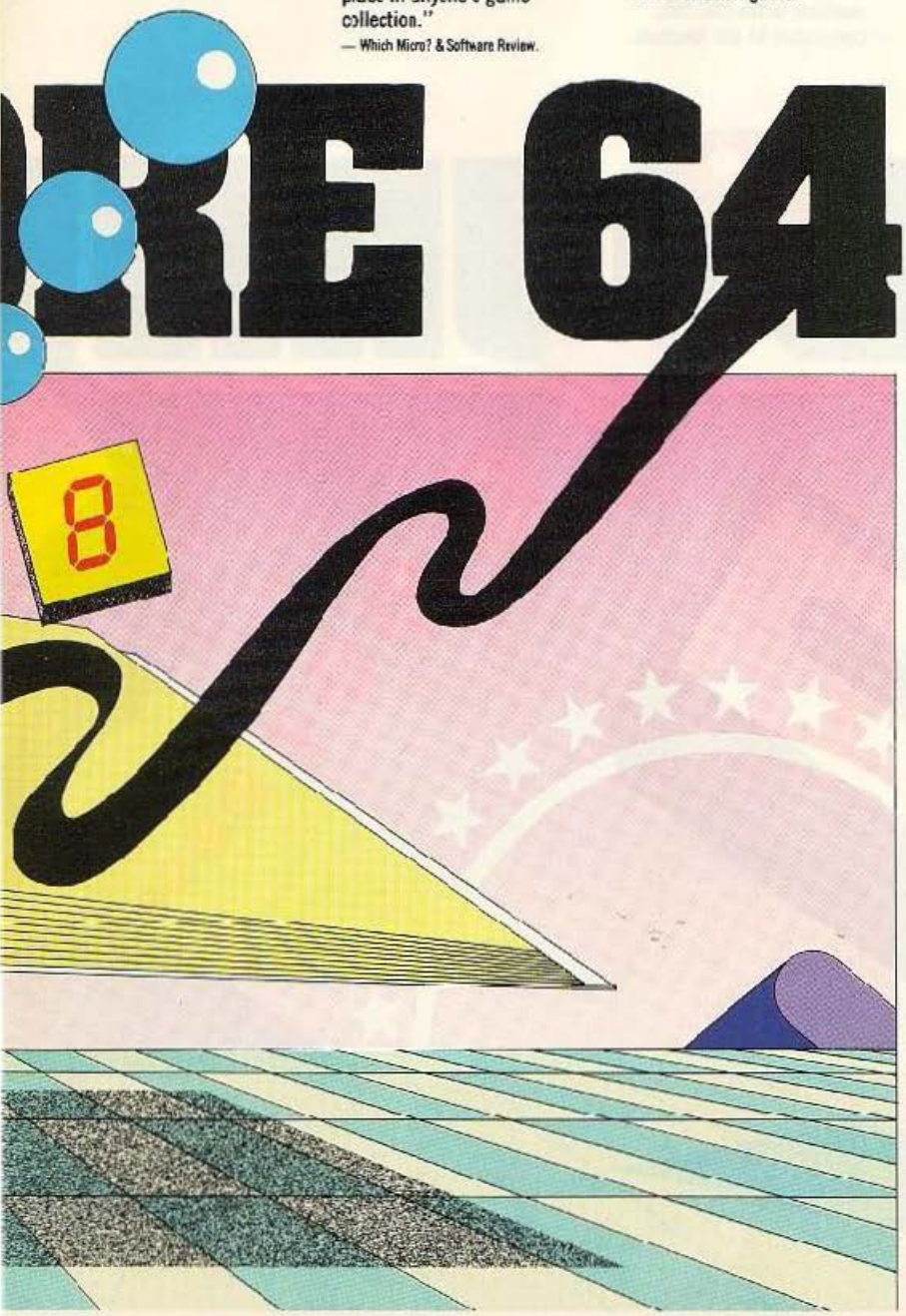

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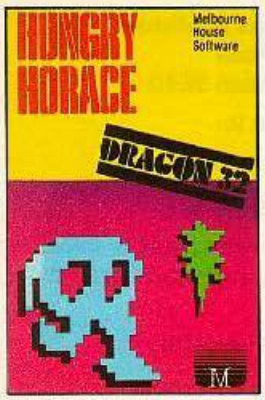

DRAGON HUNGRY HORACE. It has been said that Horace games are in a class of their own. In fact, Horace is almost a legend. Hungry Horace, the original Horace adventure, is now available for the Dragon 32.

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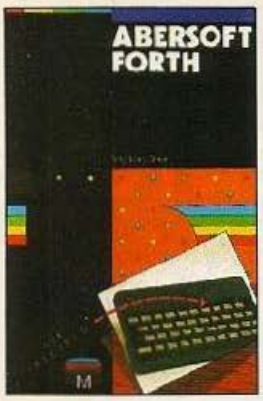

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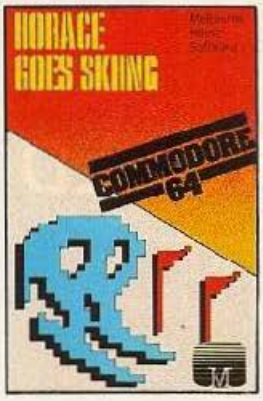
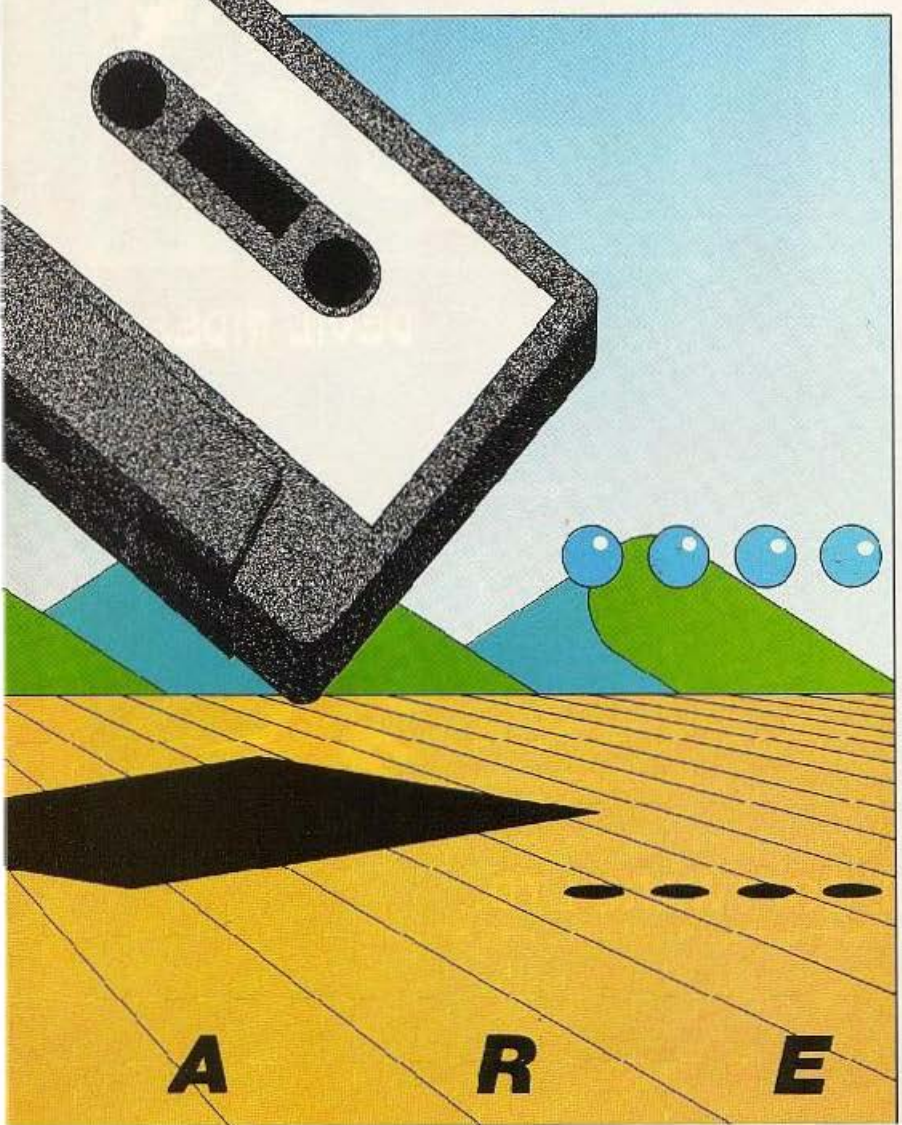


COMMODORE 64 HORACE GOES SKIING is the sequel to the very successful Hungry Horace. In this adventure our hero attemps winter sports. Skiing is complete with slalom flags, trees and moguls so watch out Horace!

HOUSE



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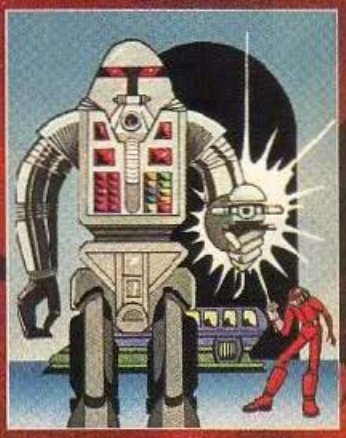

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THE DEVIL RIDES IN

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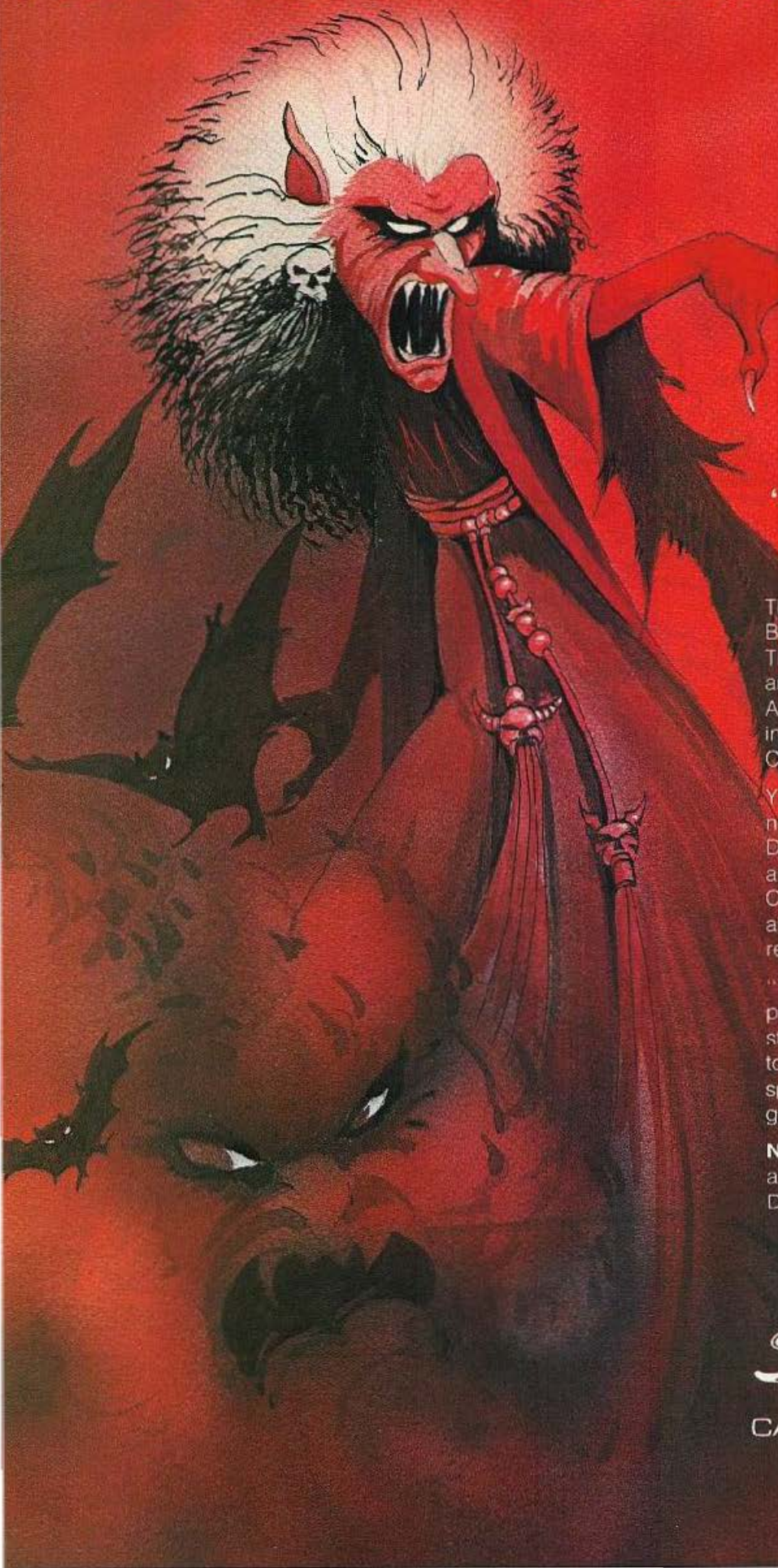

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NOTE: "The Wrath of Magra" is a complete adventure. You need not buy "Volcanic Dungeon" or "Black Crystal" to play it.

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By Jim Scarlett

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By Damian McComb

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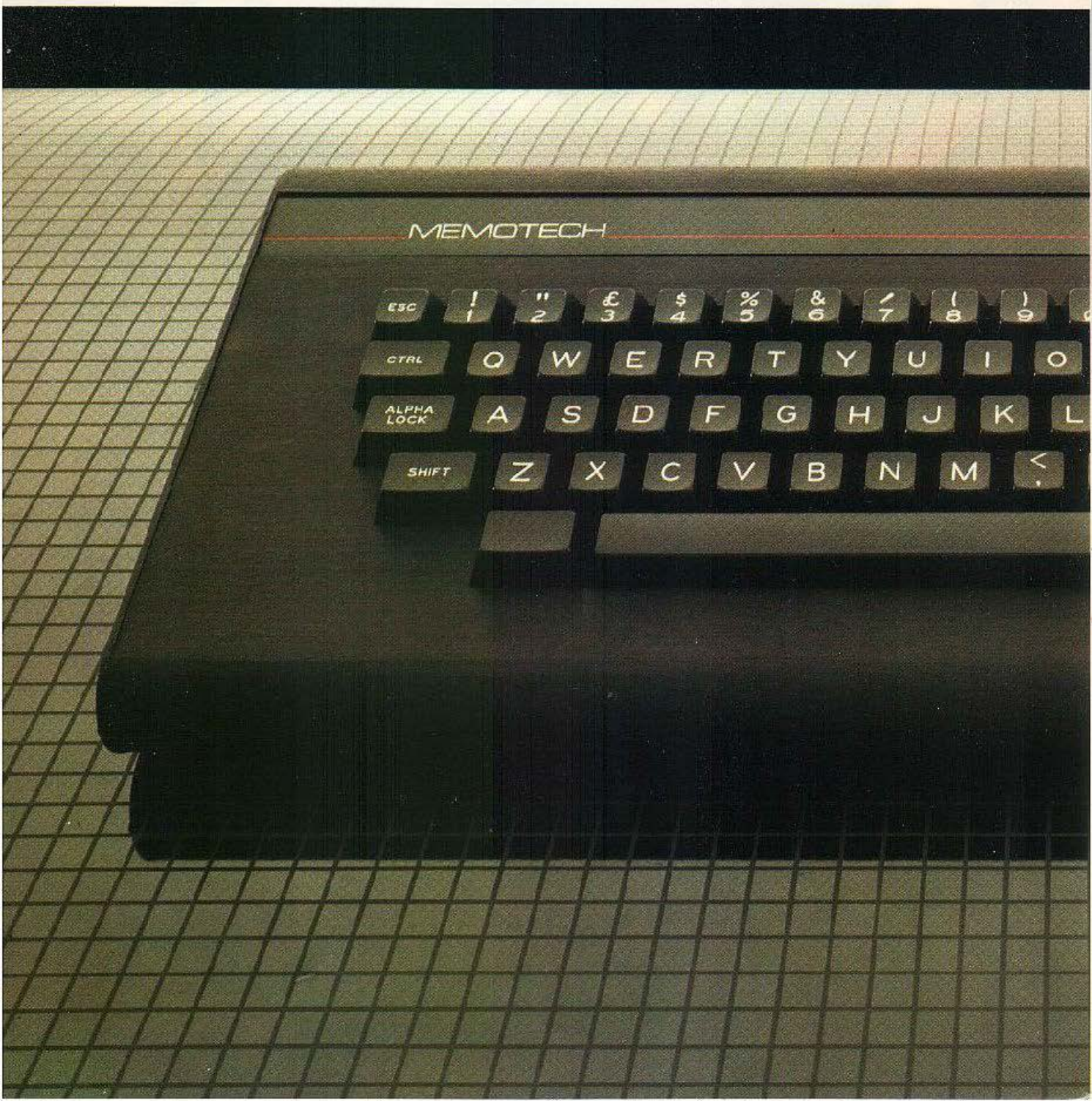
Maximising

The British computer industry is small when judged by international standards. Two large American companies control 90% of world markets. They can do this because their products represent the standard by which others are judged. When these standards are accepted by the marketplace they have the effect of stabilising the technology. Thus CP/M is accepted as the industry standard operating system for 8 bit processors, and subsequent computer development has employed this standard, with the dual effect of making both man and machine portable. Operators can use different computers, with CP/M, and software can be switched from machine to machine. For the end user the emergence of



technology

these standards is critical because they allow him to experiment with the technology without risk of entering blind alleys where systems and products disappear. In order to avoid this situation Memotech has employed these standards within the MTX Series.

In the UK there has been such rapid development in microsystems that in many cases users have been seduced by the technology rather than the standards they should be following. In educational and business applications the need for continuity is obvious. This is accentuated by the development of database technology, where very large information files are accumulated, the primary expense being the input of data. Companies and schools will not relish the idea of trying to rescue data when the standard 32 bit machines appear in two years time.

There has been a tendency for manufacturers to launch machines which are still on the drawing board, and for which no software standards exist. CP/M 80, the industry standard micro operating system, supports tens of thousands of commercially available software packages. IBM take the view that things should be done properly and *then* released to the user. This is a well tried and clearly well tested premise which Memotech has implemented in the MTX series.

The MTX Series begins with the MTX500, which costs £275.00 including VAT. The MTX512, illustrated below, costs £315.00 including VAT, has 64K of User RAM plus 16K of dedicated Video RAM and comes with extended BASIC, a powerful assembler/disassembler, Front Panel machine level editor/monitor, and Noddy, a new text and graphics processing language.

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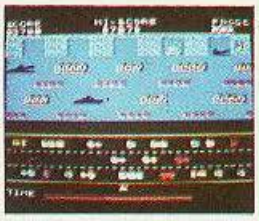

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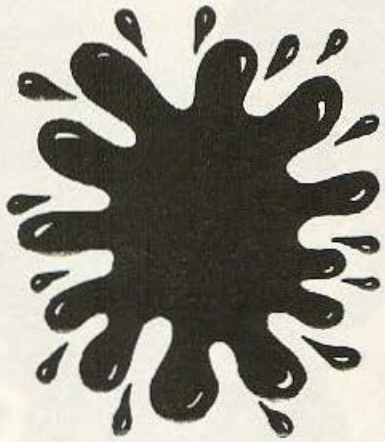

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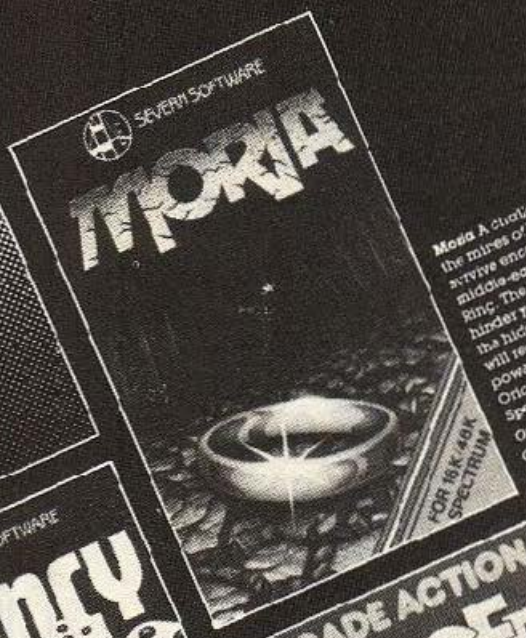

Moria A challenging adventure game set in the mines of Moria. You'll have to try and survive encounters with the monsters of middle-earth while trying to locate Durins Ring. The Wizard and Trader may help or hinder you on your journey to find and open the hidden doors to freedom – a game that will testify test your character and slaying power.
Oric Author – Adrian Sheppard
Spectrum Author – Mike Howard
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Dinky Kong Attempt to rescue your lovely girlfriend who is held captive by the angry gorilla. As you climb the connecting ladders and move along the gangways, the gorilla will be throwing barrels and fireballs at you! The only way to reach her is to leap over these obstacles and progress to the top. M/Code action with sound effects, full colour action graphics, skill levels, etc.
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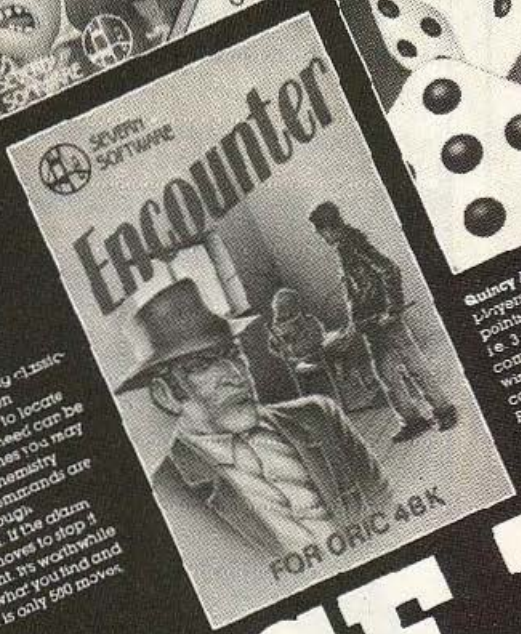

Encounter A complex and intriguing classic-style text adventure. A Girl has been kidnapped by thugs – your job is to locate and rescue her! Everything you need can be found in the game but sometimes you may have to manufacture items. Chemistry knowledge will help! Most commands are verb followed by noun although abbreviations can be used. If the alien sends you have twelve moves to stop it before you too are caught. Its worthwhile making a map noting what you find and where as the time limit is only 500 moves.
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Author – Adrian Sheppard
Oric-1 48K – £7.50
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Author – Adrian Sheppard
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Oric Atmos Extended Basic No Atmos programmer can afford to be without this program! 23 extra commands yet taking up only 3K of RAM.
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Author – Adrian Sheppard
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Author – Adrian Sheppard
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Author – Alan Hawkins
Oric-1 48K – **£6.95**
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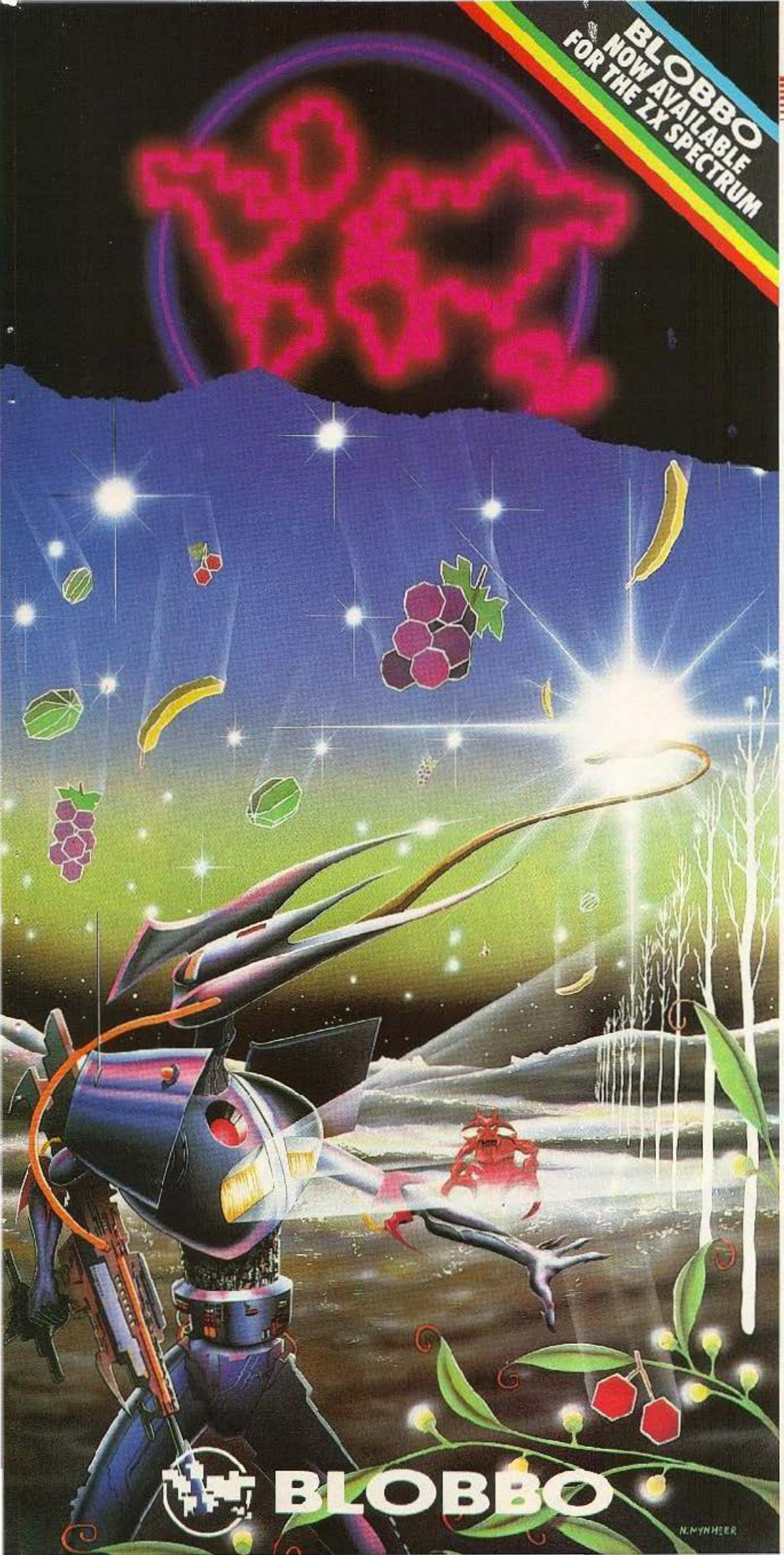

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Run at high speed around the maze collecting **treasure** and **fruit** worth bonus points – but don't get caught by the **Blobbo-eaters**! Tactical dodging must be employed to avoid them. If you're caught or step on a skull and crossbones you lose one of your three lives.

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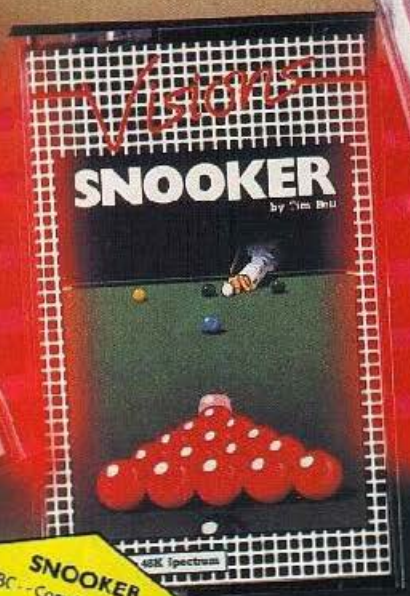

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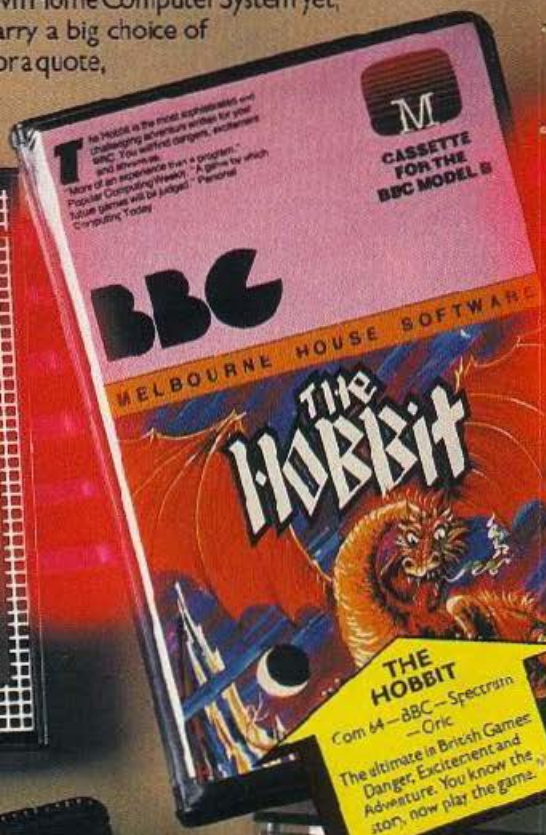

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New-Sinclair QL

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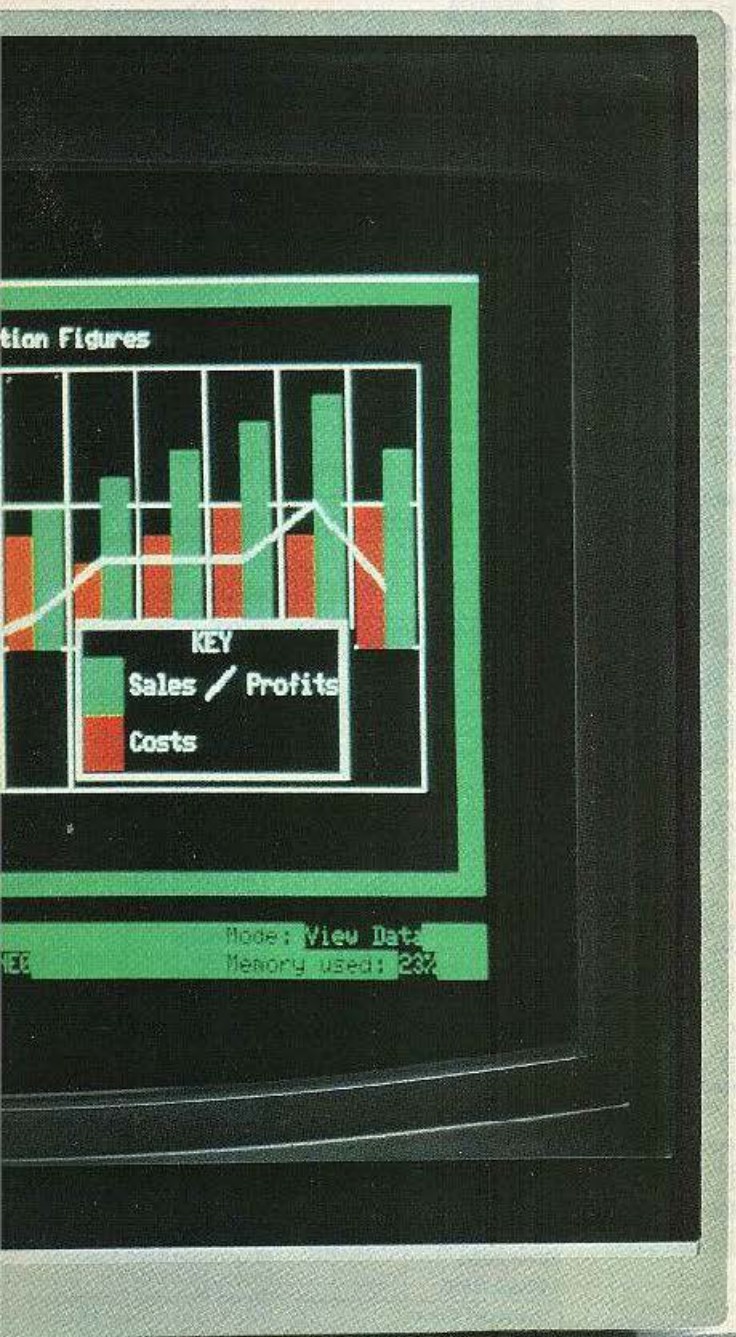

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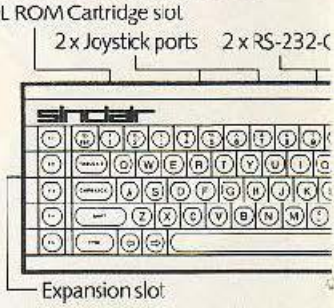
One of its most significant features is its very powerful multi-tasking capability – the ability to run several programs individually and simultaneously. It can also display the results simultaneously in different portions of the screen. These are features not normally available on computers costing less than £7,000.

Eleven input/output ports



New professional keyboard

The QL keyboard is designed for fast input of data and programs.

It is a full size QWERTY keyboard, with 65 keys, including a space bar; left-and right-hand shift keys; five function keys; and four separate cursor-control keys – key action is positive and precise

A membrane beneath the keyboard protects the machine from dust (and coffee!), and for users who find an angled keyboard more comfortable, the computer can be raised slightly at the back by small detachable feet.

(TM) Sinclair, QL, QDOS, OLUB and ZX Microdrive are trade marks of Sinclair Research Ltd.

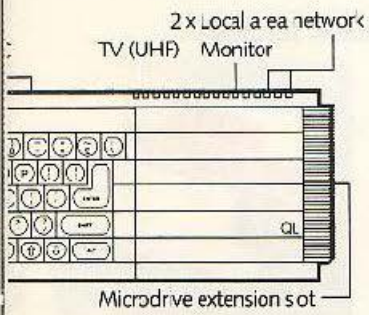
£399

because there's no comparison!

Advanced new friendly language – Sinclair SuperBASIC

The new Sinclair SuperBASIC combines the familiarity of BASIC with a number of major developments which allow the QL's full power to be exploited.

Unlike conventional BASIC, its procedure facility allows code to be written in clearly-defined blocks; extendability allows new procedures to be added which will work in exactly the same way as the command procedures built into the ROM; and its constant execution speed means that SuperBASIC does not get slower as programs get larger.



Two 100K microdrives built in

The Microdrives for the Sinclair QL are identical in principle to the popular and proven ZX Microdrives, but give increased capacity (at least 100K bytes each) and a faster data-transfer rate. Typical access speed is 3.5 seconds, and loading is at up to 15K bytes per second. The Sinclair QL has two built-in Microdrives. If required, a further six units can be connected.

Four blank cartridges are supplied with the machine.

Included – superb professional software

The suite of four programs is written by Psion specially for the QL and incorporates many major developments. All programs use full colour, and data is transportable from one to another. (For example, figures can be transferred from spreadsheet to graphics for an instant visual presentation.)

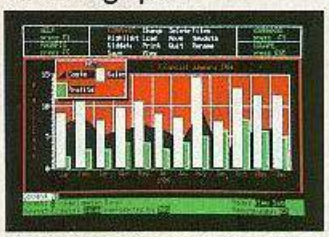
Word-processing

Certain to set a new standard of excellence, QL Quill uses the power of the QL to show on the screen exactly what you key in, and to print out exactly what you see on the screen.

A beginner can be using QL Quill for word-processing within minutes.

QL Quill brings you all the facilities of a very advanced word-processing package.

Business graphics

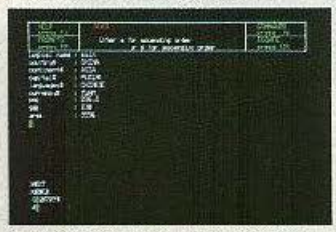


QL Easel is a high-resolution colour program so easy to use you probably won't refer to the manual. It handles anything from lines, shaded curves or histograms to overlapping or stacked bars or pie charts. QL Easel does not require you to format your display before entering data; it handles design and scaling automatically or under your control. Text can be added and altered as simply as data.

Spreadsheet

QL Abacus makes simultaneous calculations and 'what if' model-construction easier than they've ever been. Sample applications are provided, including budget-planning and cash-flow analysis. QL Abacus allows you to refer to rows, columns and cells by names, not just letters and numbers. Function keys can be assigned to change a variable and carry out a complete 'what if' calculation with a single key-stroke.

Database management



QL Archive is a very powerful filing system which sets new standards, using a language even simpler than BASIC. It combines ease of use for simple applications – such as card indices – with huge power as a multi-file data processor.

An easy-to-use labelling facility means that you don't have to ask for your file by its full name – a few letters are enough.

New – the Sinclair QLUB

The QLUB is the QL Users Bureau. Membership is open to all QL owners. For an annual subscription of £35, QLUB members receive one free update to each of the four programs supplied with the QL, and six bi-monthly newsletters. Sinclair has also made exclusive arrangements for QLUB members to obtain software assistance on QL Quill, Abacus, Archive or Easel by writing to Psion.

The Sinclair QL challenge

If you're seriously considering any other computer, post the coupon for a blow-by-blow comparison. We'll take a *published* comparison chart for the machine you're considering (not one we've created ourselves) and give you the Sinclair QL figures, detail by detail.

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Please do not use this number for other enquiries.

For more information

Phone Camberley (0276) 686100, or use the coupon to get a QL brochure. Due to demand, delivery may take more than 28 days. Your order will be acknowledged immediately with an expected shipment date. Remember that Sinclair offers a 14-day money-back undertaking.

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	Postage & packing (any order over £390)	6999	7.95	

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Sindair Research Ltd, Stanhope Road, Camberley, Surrey, GU15 3PS.

(TM) Quill, Easel, Archive and Abacus are trade marks of Psion Ltd.

Small business can now stop going by the book.

For under £1,000 a small business can now equip itself with a BBC Microcomputer, a disc drive, a word processor and printer.

(All tax deductible by the way.)

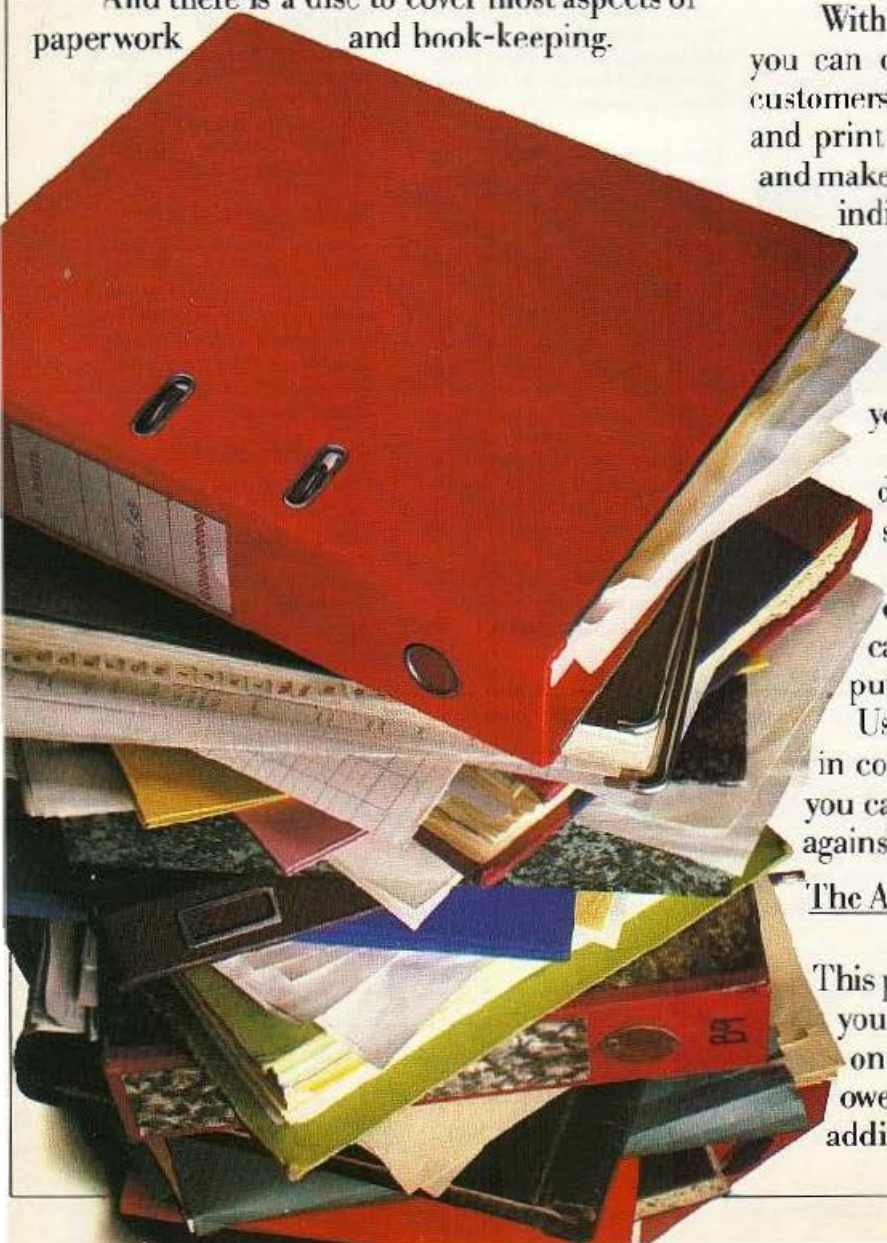
Once you've parted with that money, you'll find that business has never been brisker.

Because now, there's a new series of floppy disc software specially for the smaller business.

It has been developed by Acornsoft, the software division of Acorn Computers who are the manufacturers of the BBC Micro.

For only £24.95, each disc can store volumes of vital bookwork which can be updated and amended in a fraction of the conventional time.

And there is a disc to cover most aspects of paperwork and book-keeping.



The Invoicing package.

This program stores details of products, VAT numbers and, of course, the names and addresses of your customers. As orders come in, you simply record them. Then, when it's time to invoice, you just press a few keys and each invoice or credit note is printed automatically in seconds.

Allowing for variable terms of trading, the system calculates and prints discounts. And it should help to improve your cash flow dramatically.

The Order Processing package.

With this program, you can confirm your customers' orders, prepare and print despatch notes and make fast analyses of individual orders or of all the orders stored on disc.

The Accounts Receivable package.

Now, it couldn't be easier to keep your customer accounts under control.

In an instant, you can analyse debtors, produce statements, keep a check on any credit limit and calculate VAT output automatically.

Using this package in conjunction with the invoicing package, you can also keep tabs on payments received against payments outstanding.

The Accounts Payable package.

This package will keep you fully up-to-date on how much you owe and who to. In addition, it calculates

input VAT and, used with the Accounts Receivable package, produces instant VAT returns.

It also highlights settlement discounts, produces remittance advices and provides an immediate analysis of all creditors.

The Stock Control package.

Touch a few keys and you have instant access to stock status and automatic analysis by quantity and value.

Consequently, it's easy for you to maintain correct stocking levels, having an early warning of out-of-stock situations or the likelihood of over-stocking.

The Purchasing package.

All your suppliers' names and addresses go onto the disc. Then they can be retrieved instantly for preparing and printing orders.

All order data can be recalled in seconds, allowing you to check on orders, and suppliers' invoices and to record all deliveries.

The Mailing package.

Instead of the shotgun method of sending mailshots, this package enables you to refine each mailing down to the customers who are most likely to respond.

It gives you a rapidly accessible mailing file of your customers, according to any criterion you choose. Size of company, for instance, or type of business. Average value of the business they do with you, or whether they are good or bad payers.

Then, when you are doing a mailing, you simply choose the group or groups of customers you want.

At £24.95 each, these packages could be priceless.

Each package comes with clear instructions on how to get the program running so that you can devote much more of your time to more profitable activities.

If you're a credit card holder, you can order any or all of the packages by ringing: 01-200 0200 anytime. Or 0933 79300 during office hours.

(By ringing the same number, you can get the address of your nearest stockist, or full details of the BBC Microcomputer system if you don't already have one.)

Alternatively, you can order the packages by sending the order form below to: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL. Please allow 28 days for delivery.

☎ Credit card holders, phone 01-200 0200, anytime. Or 0933 79300, during office hours.

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Accounts Payable			SNB 13
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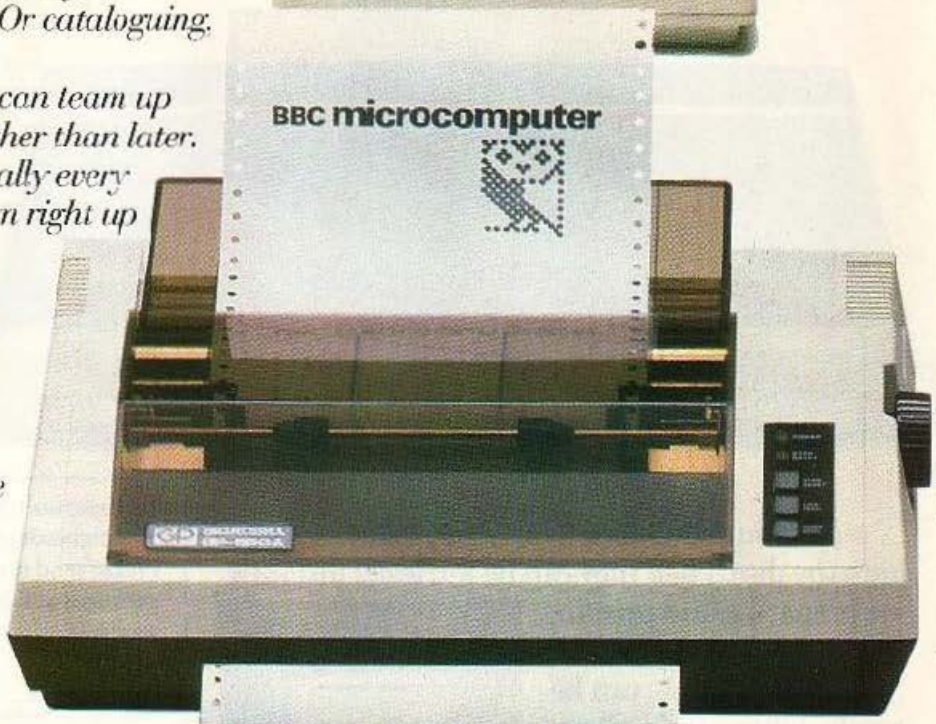
If you want to make the most of your micro, sooner or later you'll need to add on a printer. To help with preparing and debugging programs for example. Or preparation of reports. Or cataloguing. word processing and file listing.

Low Seikosha prices mean you can team up with the printer you want sooner rather than later. The wide range interfaces with virtually every computer from a Dragon or Spectrum right up to Apple and IBM.

Designs are sophisticated, performance is versatile and reliable and quality is all you'd expect from the name Seikosha.

Get hold of the full picture - ask for a demonstration at one of the dealers over the page.



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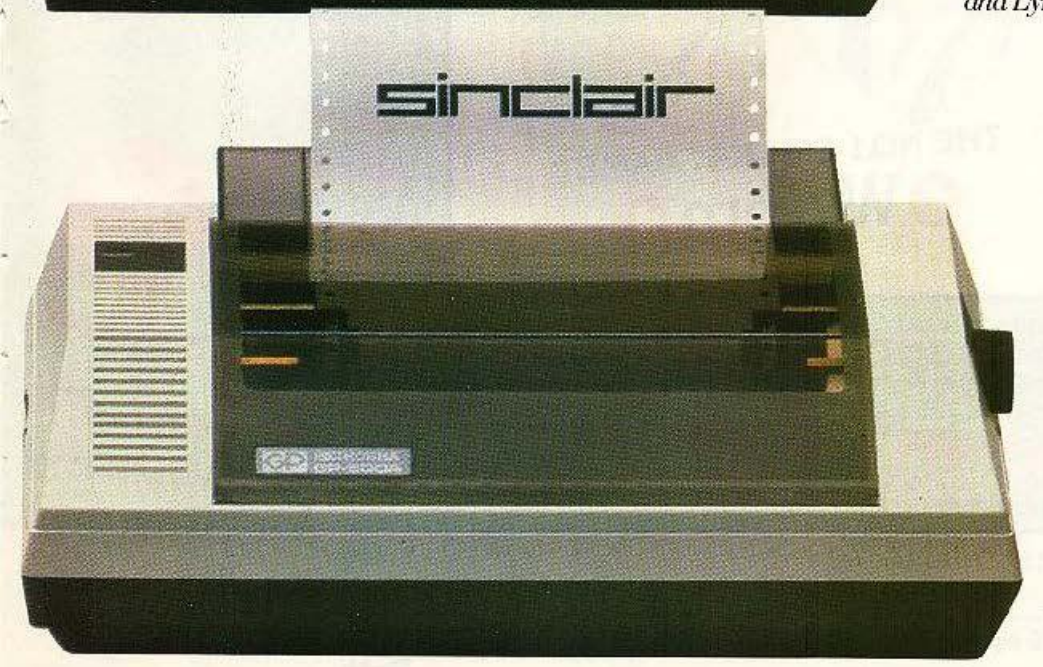

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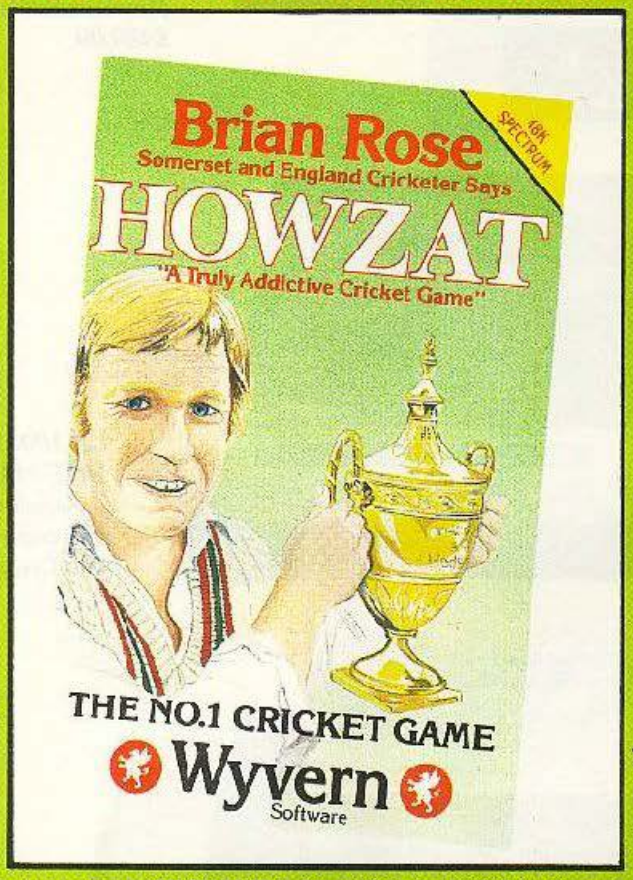

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Eight directional movement, with or without the fire button being pressed, can be achieved by only programming the left, right, up, down and fire keys required by the game.

Programming is achieved by a two-digit code, which is looked up on the Programming Chart supplied, for each direction and firing button. These two numbers are then selected on a pair of leads which are clipped onto appropriately numbered strips on the interface.

Once configured this can be marked onto a Quick Reference Programming Card for storing with the game. As the programming is *not* power dependent the interface can be immediately used when next switched on.

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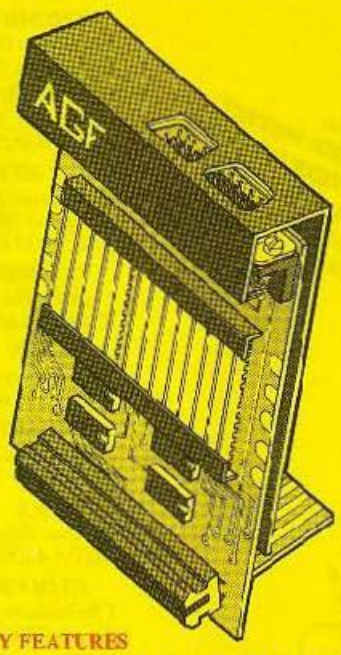
An integral rear expansion connector means there is no need to remove the interface to connect other peripherals.

NB. A recent design improvement now means that the AGF Programmable Interface works with the new Quickshot II rapid "Auto Fire" feature.



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SINCLAIR'S NEW Q-LENGTH

Sinclair seem to be going down a familiar path, one would have thought they'd have learned by their experience with the Spectrum — but no.

On February 13 I rang the enquiry number 0276 686100 given in the QL brochure to enquire what the current delivery situation was. I was told it would be 28 days from receipt of order, as this was rather important to me I asked if the lady was absolutely sure about this, she replied "Well it could be as much as five weeks, would you like to order one now?" I did order one but I am now wondering if I did the right thing as what I was told would now seem to have been a blatant lie.

According to recent articles in computer magazines Sinclair were in fact in the process of sending out letters to people who had already ordered to say that there would be a delay in delivery. These letters were already in the process of being sent before I ordered, it seems that the people who ordered in the first week will not receive their QL's until the end of April, that does not give me much chance before the end of May.

I think it is about time Sir Clive started to treat his customers with just a little more respect instead of abusing their faith in his products. It is now two weeks since I ordered and I have not even received the confirmation of order which I was told would be sent in a few days.

If I knew from the start that I would have to wait 12 weeks that would be fair enough, I feel sure all customers would prefer to be told the truth right from the start and plan accordingly — there is no excuse when they know full well that they are not in a position to deliver in the stated time.

Bryan K. Lee,
Nuneaton,
Warwickshire.

MANIC MINER

I was probing through Manic Miner the other day and I encountered a fantastic "Bug". It proves that it is perfectly possible to choose any of the 20 stages to look at and/or begin a game on . . .

It involves typing in a sequence of numbers at the start of a game these are as follows:

6 0 3 1 7 6 0

A boot identical to the one that squashes you at the end of any normal game then appears at the bottom left of the screen next to the dancing figure of Miner Willy.

Then you press a combination of numbers to select the stage desired. For example:

To begin on the 20th stage, the four numbers: 1-2-5-6 have to be held down all at once and released at the same time.

You will then begin on the 20th stage!

To select other stages such combinations as 2-4-6 have to be pressed. By trial and error all can be selected at any one time. But all of them contain a 6 and none of the numbers are more than 6.

Ben Hardyment,
Clapham,
London SW4.

MONSTERS' LAIR

With regard to my Atari program Monsters' Lair which appeared in the February issue of your magazine it would appear that two lines have become corrupted in your printed listing from the supplied tape. In addition the inverse characters have not appeared in their correct form in the magazine. I should therefore be grateful if you could publish the following corrective article within your pages at the earliest opportunity.

Two lines have corrupted during the printing process. The correct versions are shown below:

```
Line 710 IF PEEK (632)<>15 THEN
BONUS = BONUS + 1:SOUND 2,20*
(PRIZE>0),0,15:SOUND 2,0,0,0:IF
BONUS = 75 THEN GOSUB
25:BONUS = 0
Line 3500 ?"AAAAABBBAAAAAA
CCCAAAAAACCCAAAAAABBB
AAAAA";
```

But replace 'A' with a normal %
replace 'B' with an inverse control R
replace 'C' with a normal space

In addition the following characters should be printed in inverse form as they appear in the listed lines:

Line 20 #
Line 625 0
(within the quotes)
Line 1530 #
Line 3840 SHLD = 90
Line 3840 bon
Line 3850 #
Line 7110 diff level

Line 7110 initialise
Line 7200 initialising
Line 7200 min
Line 8050 lair
Line 8060 energy used
Line 8070 time taken
Line 8100 OPTION
Line 8100 SELECT

The notes regarding inverse characters are quite important on the Atari machine since they control colour and are required to balance the screen display.

Dave Hitchens,
Blackpool,
Lancashire.

PROGAID BUG

My ZX-81 program Progaid published in March contains a bug which will cause the program to crash if Merge is implemented in Slow mode. It will however work properly in Fast.

To correct the bug three extra bytes have to be inserted in the listing at 16623. The three missing bytes are CDE702 and their insertion means that everything between 16623 to the end, 16937, has to be shifted three bytes down.

The program will now be 402 bytes long ending at 16940. In addition the addresses of the facilities RT-Down, PGM-SVR and Merge will be reduced by three bytes. Merge, for example, now starts at 32450 instead of 32453.

Albert Olivero,
Gibraltar.

ORIC ADDRESSES

Having read S. Tighe's letter in the November 1983 issue of *Your Computer* which listed some Oric memory addresses, I thought that those readers who own Orics, especially those like myself who enjoy dabbling with machine code, may be interested in a few more addresses from ROM routines:

#F412 'PING'
#F415 'SHOOT'
#F418 'EXPLODE'
#F41B 'ZAP'
#F41E 'SOUND'
#F421 'PLAY'
#F424 'MUSIC'

The parameters for the last three commands should be placed as a series of two-byte integers, starting at location #2E1 (737), in the same order as for Basic, before linking to the routine with a JSR.

Also, four of the locations listed in the aforementioned letter, have another use which the author did not give. Locations #26D and #26E (621/2) contain the start address of the screen (normally 48000), and #26F (623) contains the number of lines in the scrolled area of memory. Decreasing the latter and adding to the former — in increments of 40 — creates a "window" on the display starting at the address held in location 621/2 consisting of a number of lines determined by the contents of location 523.

This protects the rest of the display from overprinting and

HELP TO COMPILE GAMES TOP 20

To all micro owners. Have you bought a pre-recorded cassette lately? What standard was it? Whatever your answer, this survey is for you.

I want you to send me a list of your top 20 games you've played on your micro — Vic-20, Oric, CBM 64, ZX-81, Texas, Spectrum, Atari, BBC B, and Dragon. I don't mind if it's your cassette or not. All I want to know is your favourite 20 games in order. Please state the memory required and the company who makes the game. Do your list for one micro only. Please state which on your list and on your envelope.

We will then analyse the results which will then be published later on. We will be able to find the top 20 games for each of the top selling micros.

This will be one of the biggest software surveys conducted in any of the computer books on sale in any newsagent.

Please include your name and address as I hope that some software houses will donate some cassettes as prizes. The prizes will be given to the person who's entry is closest to the one published, if no one is correct then the games will be witheld and added to the prize next time.

We have already completed a small survey using magazines, schools, youth and computer clubs. Please send entries to the following addresses:

Nigel Sutton, 18 Claypole Drive, Northborough, Peterborough, PE6 9DW or Chris Mahon, 4 Clare Road, Northborough, Peterborough, PE6 9DN.

scrolling, but to change the colour of only the window it is necessary to Poke 619 with the required background attribute — or any other character — and to Poke 620 with the foreground attribute, then to CLS. This technique can be used to protect headings or to put text under a picture without writing over it.

Two more locations which may be useful are 537 and 538 which contain the hi-res X and Y co-ordinates and can therefore be used in testing for out of range parameters with the Draw or Curmov commands.

Andrew J. Eagington,
Norwich,
Norfolk.

MILLIPODS

In the March issue of *Your Computer*, three errors crept into listing 2 of Millipods:

```
210 IF ASC(B$)>60 THEN etc
230 C = S*16
250 IF ASC(B$)>60 THEN D = etc
```

Peter Tomson,
Tamworth,
Staffordshire.

TUNNEL RUN

People who have entered my program Tunnel Run which was printed in Software File in the March issue will have got an error when running it. This is because the text says the @ character should be typed instead of the £ character. This would have been correct if my listing had been used but because you printed your own it is not. The correct character to be typed is the hash symbol. The lines which will need altering are 410, 1480 and 1750.

If you wish to make stage 2 of the game harder, enter the line 785 M2=6. This will give a roof to the tunnel.

M. Severs,
Walton-on-Thames,
Surrey.

STOPPING COPIES

Many people that make their own programs and lend them to friends or eventually sell them become surprised with the quick proliferation of unauthorized copies of their own work.

For owners of Spectrum machines I will suggest a small trick that will make any user have to sweat infinite hours of pain and frustration to copy a private label program.

The non-mergeable/non-stop loader. If your programs are in machine-code load them through a Basic header-come loader of the following type:

```
1 Poke Val "23785", Not PI:Poke Va
"23659", Not PI
2 Go To Val "9999"
9990 Rem to save the loader
9995 Poke Val "23785", Va
"255": Save "Loader" Line Va
"1":Stop
9999 Rem Insert here LOAD"", if
Basic or Load ""Code:Randomize
USR Address f M/C.
```

José Alberto P. Pascoa,
Lisbon,
Portugal.

EDITORIAL

WHILE QL DELAYS MAY be bad news for the early orderers, they could be a blessing in disguise for the rest of us. Every time a new wonder machine appears on the market the supply of software for one of the old favourites seems to dry up.

The million-plus ZX-81 and Vic-20 owners already know what it feels like to be left out in the cold. The flow of commercial programs for these two old-timers slowed to a trickle soon after the Spectrum and the CBM-64 had arrived in a big way, and as the software houses turned their attentions to these new rising markets.

What interests the program-makers are computer users and not computer owners. The hundreds of thousands of Vics and ZX-81s did not just vanish overnight. They either became second-string machines as their owners moved up *en masse* to larger and more sophisticated micros, or were judged by the software manufacturers to have passed their first year of use when most money is spent on buying programs.

Those who stuck with these machines from the outset and those who bought one after their sales had reached a peak are rewarded with a dwindling choice of programs: software houses prefer the areas of increasing demand.

The programming effort that goes into a new computer is enormous. It often pushes the micro's capabilities well beyond the original expectations of both manufacturer and public. Compare, for example, the quality of early Spectrum software with what can be achieved today.

Machines that are in decline do not receive that kind of attention. So not only is no progress made, but they actually go backwards relative to the latest micros. As this software gap widens between old and new machines, yesterday's computers become even less attractive to buyers.

Add to that the fact that commercial programmers are just as subject to the whims of fashion as the average computer enthusiast. Professional program writers prefer to work on the computers that are in vogue. Not only will the royalties involved be higher but the end product is more rewarding. We may find our present generation of Spectrum programmers drawn to the QL by the pull of its 68008 processor.

In the mercurial software market the program-makers feel they must be seen to be up in the forefront, servicing the latest technology. Even if there is still money to be made in the Vic and ZX-81 markets, software houses are afraid to be branded as behind the times by providing new programs for them.

They also maintain that as well as the difficulties of selling software into the static or dying markets of the older machines, the volume of pirated packages that accumulates once a micro has been around for a couple of years makes creating new software a pointless task.

In any case the big multiples like WH Smith or Boots have the final say. Faced with the choice between an excellent new Vic program or one for the CBM-64, the multiple would choose the one for the newer, better-selling machine. That would leave the software house with the fading mail-order market as its only other distribution option — not a very attractive prospect.

The acres of shelf space in the growing number of software supermarkets may offer owners of classic micros a ray of hope. Picture dropping a software flavour of yester-year into your Saturday morning shopping trolley. If that fails to become fact, the image of QL owners in a few years reduced to ferreting around in junk shops for rare programs may be a small consolation.

How to write for *Your Computer*

We called this magazine *Your Computer* precisely because we welcome your views, tips and hints and even your criticism of machines and software in general. If you would like to see your name in print, whether on a Software File program or a full-blooded article, here is how to go about it. Ideally, all articles should be typed double-spaced on one side only of uniform sheets of paper. If listings can be dumped directly from a printer — you can always use a friend's or user group's — this minimises the risk of error. In a perfect world a cassette would accompany the article. That considerably speeds up the checking process. Not only do you get to air your own discoveries and opinions, but we will even pay you for the privilege. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

Why not give it a try? You have nothing to lose but your postage.

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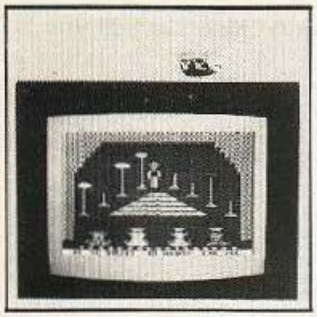


Hungary for a take-away

CHINESE JUGGLER is the first computer game from Hungary. It runs on the Commodore 64 and is sold in Britain by Ocean Software for £6.90. Juggler won an ideas competition on Hungarian TV and was written by a mathematician, an artist and a musician.

Don't call me Elan, Flan, DPC or Samurai — just call me very late

SPRING will be a little late for the Enterprise this year. Chip delays and yet another change of company name mean that the £200 computer will not be released till September instead of April as originally promised.

Last September when details of the micro then called the Elan Enterprise were released its ultra-high resolution, massive range of colours, 64K RAM, built-in word processor and joystick seemed the ideal home computer but it had already had an unfortunate problem with its names. In the early days of the project which was managed by Intelligent Software it had been code named DPC — damp proof course — but it was first advertised as the Samurai Home Computer. Legal action by another micro firm called Samurai forced a change of name and after a brief flirtation with the name Oscar the company settled on Elan.

Unfortunately, Elan Digital Systems of Crawley were less happy with the name the makers of the Enterprise Marketing Manager Mike Shirley told a gullible computer press that he was considering changing the name to Flan but the company is actually negotiating with an American firm to buy a new name with a futuristic Space travel ring about it. Names like Apollo, Gemini and Mercury have been suggested. The change of name will delay the whole project because here will have to be some retooling and changes will have to be made to manuals and advertising materials.

At the same time there have been problems debugging the ambitious Nick and Dave video and sound chips in the Enterprise. The computer will be built by Welwyn Electronics at a plant on Tyneside which will create 90 jobs.

What William Morris — the nineteenth century artist, writer and craftsman would have made of digital watches or interior designer programs for the Spectrum is perhaps fortunately unknowable. He found it difficult enough to adjust to the mass production of the Victorian age but the Institute of Contemporary Arts is celebrating the 150th anniversary of his birth with an exhibition including a computer generated image of his Red House which can display 16 million different colours — presumably including red.

At the same time Richard Williams has set up his own cottage industry producing Spectrum Interior Designers programs which allow you to try out different layouts of furniture on screen. Phone 061 440 0333 for Richard Williams. The ICA exhibition is on at the Mall in London till 29 April.

Shaking all over about the pirates

NICK ALEXANDER of Virgin Games is accusing the Government of "endorsing and giving actual support to computer pirates". This follows the Ministry of Defence ban on JLC Data using a new anti-piracy system on the grounds that it might be a threat to national security.

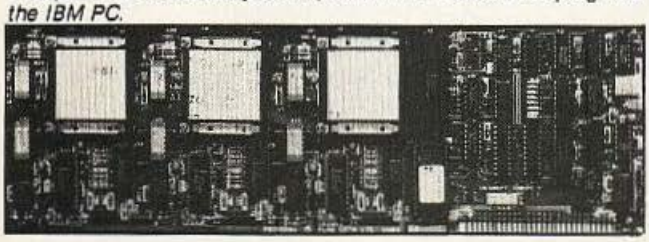
Nick Alexander is asking the Government to "compensate the games industry for the £100 million theft which there is every chance this new system could prevent". At the same time the Guild of Software Houses is trying to persuade magazines to stop publishing advertisements for copy-cat programs.

Bruce Everiss of Imagine calls for the Government to change the law so that computer pirates can be treated in exactly the same way as video pirates. Other figures in the record and software industries are calling for a levy on blank cassette tapes.

More 6502 for Acorn

ACORN IS FINALLY releasing its 6502 second processor for the BBC Micro which also gives at least 50K of user memory in any graphics mode.

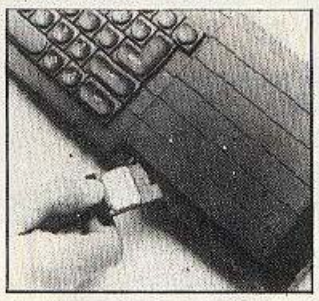
Shapes of things to come: The 16-bit Grid portable, above, which was used on the space shuttle with its 256K RAM, 384K bubble memory and built-in Modem and flat screen is probably what a typical £300 computer will look like in a couple of years. Below, cheapest bubble memory so far, £600 for a 128K unit to plug into the IBM PC.



Easy one for pocket desk

EASY-ONE is an attempt by Elkan Electronics to turn the Sharp PC-1500 pocket computer into an instant work desk. It contains Calculator and Statistics, programs, a 400 word Notepad, an Alarm which can display short messages when it sounds such as "RING DAVID NOW", Text a mini-word processor and a handy currency and measures conversion program. Easi-one costs £25 on tape and it requires an 8K or 16K RAM module and the CE-150 cassette interface.

Microdrives but no QL



EVEN IF SINCLAIR holds to his promise and supplies the first QLs to customers this week most of the thousands of people who have already ordered will have to wait three or four months instead of 28 days for delivery. Sinclair is already quoting delivery dates well into June for those who sent their order forms in at the end of January.

A few QLs which have found their way out by backdoor means and with incomplete ROMs have been changing hands for high prices behind the scenes as software houses race to be the first to produce QL games and applications.

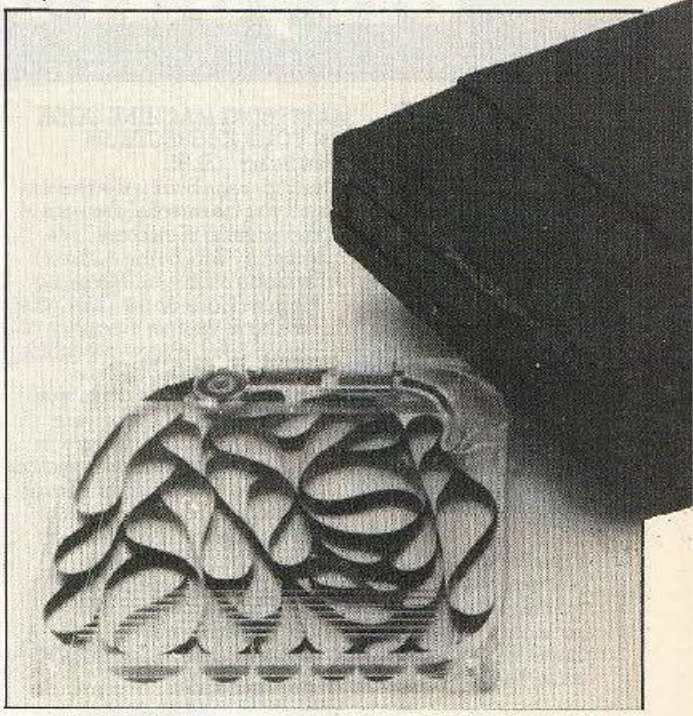
That's no tape recorder — its a mass storage system

TWO NEW high-speed tape drives, the £80 Ultra-Drive and the £120 Floopy, claim to offer disc-style mass storage for a fraction of the price.

If the claims sound familiar from Sinclair Microdrive advertising that is because the technology is similar. Phloopy, from Phi Mag Systems in Falmouth uses a continuous loop of tape in a cassette which passes a nine-track recording head. Unlike the Sinclair the tape is not twisted over on itself.

Eight of the tracks carry data giving each a cassette a capacity of 100K, and the ninth tracks for error correction. Phi Mag claims an average access time of just three seconds and with a data transfer rate of 10K bytes a second it takes just another three seconds to load a 32K program.

Ikon's Ultra Drive which uses a conventional Philips mini-digital cassette is slower but costs only £80 as opposed to £115 for the Floopy. Access times can be as slow as 90 seconds but capacity is 200K per cassette. Initially Ikon, on 099-421-515, will produce Dragon and BBC versions of the Ultra-Drive with Oric, Electron and Commodore variants to follow in the Summer. The Floopy is BBC only but Phi Mag hope to make other versions available later.



International links of Spectrum mob

AFTER DESIGNING everything from guided missiles to robot submarines you might think that inventor Brian West would find making Modems for home computers rather unexciting — but not a bit of it.

His new Spectrum Modem will allow you to transmit programs or play interactive games with other Sinclair owners abroad or in other parts of the country. He has spent the last month testing the new half-duplex unit with connections between his Bristol base and identical machines in London, Paris, Lisbon and Copenhagen.

Brian West is not the only one producing new Modems. This is Minor Mirades WS2000.

Brian West started by producing simple £50 acoustic couplers for the ZX-81 and Spectrum under the name of MicroMyte. His new unit uses a half-duplex Modem which senses how good a telephone line is and adjusts its speed to send the data as quickly as possible.

At first it tries to send data in blocks of 500 bytes each with a checksum to make sure that interference on the line has not caused errors. If after three tries it cannot send a block through it will change down a gear and send data in blocks of half that size. Eventually if the line is bad enough it will go all the way down to 32 byte blocks.

In practice Brian West finds that except in the busiest periods when the telephone lines are noisy he can send data at top speed in 500 byte blocks though on some international lines the Modem changes down to quarter speed.

Micron Eye for the Commodore 64 adds vision to your computer. Details from ESI (0256) 57166.

Jupiter Ace, Forth micro at a third of the price

AT LESS than a third of its original price the £26 Jupiter Ace being sold by Boldfield Computing becomes the cheapest home computer ever sold in Britain. Boldfield is selling off the remaining stocks of Jupiter Cantab which went into liquidation last year.

RAMpacks and software for the Forth based computer are also available which may cheer up any owners who are sickened at the thought that they paid £89 for their Aces less than a year ago, and now find themselves without support. Boldfield is on 0487 840740.

Vadas is what Voice input of St Ives is calling its new speech activated room designed for the disabled. It consists of a voice entry connected to a micro with a disc drive which allows a disabled person to use a cassette player or dial a phone number, open or close curtains and turn on and off a fire, all without touching anything.

At last!

MASTER MACHINE CODE on your Spectrum

MASTERING MACHINE CODE ON YOUR ZX SPECTRUM
Toni Baker £9.95

This 315-page book is designed to teach you the essential elements of programming in machine code. Written by Toni Baker author of the highly successful 'Mastering Machine Code on the ZX81', this new book assumes absolutely no previous knowledge of machine code whatsoever, and yet promises to take you to a level of proficiency beyond your wildest dreams. Starting with simple addition and subtraction you'll be slowly guided through the entire subject of machine code. The book explores and utilises the incredible speed of machine code, giving you real time graphics games like BREAKOUT and leads you up to a full working DRAUGHTS program. Among other useful skills you'll acquire the ability to create music in real time (impossible in BASIC) and to plot in high-resolution graphics faster than you would have believed possible.

SPECTRUM MACHINE CODE MADE EASY
Volume One — James Walsh
Volume Two — Paul Holmes

These two books provide a graduated course in machine code programming on the ZX Spectrum. Book one starts off with the basic concepts of machine code, followed by an explanation of binary maths, hexadecimal and base conversion, leading as quickly and painlessly as possible onto the rules and types of addressing the Spectrum's powerful Z80 microprocessor. Book two is designed for those who already understand the rudiments of machine code programming, and now wish to increase their skills.

Each book is just £5.95

THE SPECTRUM MACHINE CODE REFERENCE GUIDE
Microdrive, Interface 1, and ROM Disassembly
Richard Ross-Langley £4.95

This 170-page reference work for Spectrum machine code programmers contains a full disassembly of the Spectrum ROM, with details of the Microdrive and Interface 1. Features of the disassembler include: Zilog mnemonics are used, eg LD A, (HL) instead of MOV A, M, relative jumps show the signed decimal offset and the result; hex values are default and are printed without suffix; decimal values are preceded by a plus or minus sign; and some restart instructions are followed by data bytes. The absolute addresses of all system variables and several important routines have been named, using where possible the standard names shown in the manual. The chapter headings in the Microdrive/Interface 1 section of the book include the RS232 Interface; Microdrive Channel data; Local Area Network; Network Algorithms; System Variables; and a summary of functions. **This book is a must reference work for serious Spectrum machine code programmers.**

Interface Publications, Dept. YC, 9-11 Kensington High Street, London W8 5NP.

Please send me the following books. I enclose £_____

- ☐ Mastering Machine Code on your ZX Spectrum — Toni Baker — £9.95
- ☐ Spectrum Machine Code Made Easy, Volume One for beginners — James Walsh — £5.95
- ☐ Spectrum Machine Code Made Easy, Volume Two for advanced programmers — Paul Holmes — £5.95
- ☐ The Spectrum Machine Code Reference Guide — Richard Ross-Langley — £4.95
- ☐ Creating Adventures on your ZX Spectrum — Peter Shaw and James Mortleman — £4.95
- ☐ Putting Your Spectrum to Work (includes 15 major programs, including a word-processor and spread-sheet calculations) — Chris Gillender — £4.95
- ☐ Creating Arcade Games on the ZX Spectrum — Daniel Haywood — £3.95
- ☐ Programming Your ZX Spectrum — Hartnell/Jones — £6.95
- ☐ 60 Games and Applications for the ZX Spectrum — David Harwood — £4.95
- ☐ Beyond Simple BASIC — Delving Deeper into your ZX Spectrum — Dilwyn Jones — £7.95
- ☐ Instant Spectrum Programming (tape and book) — Tim Hartnell — £4.95
- ☐ 20 Simple Electronic Projects for the Spectrum — Stephen Adams — £6.45
- ☐ Giant Book of Computer Games — Tim Hartnell — £7.95

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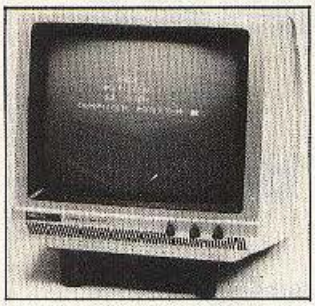


Philips new £70 12in. monochrome computer monitor keeps the family TV clear for Coronation Street, but at that price it is competing with larger second hand colour sets for a place in the computer room.

YOUR COMPUTER TOP 20

Game	Company	Machine
Atic Atac	Ultimate	Spectrum
Boogaboo	Quicksilva	CBM 64
Caverns Khafka	Centresoft	Atari
Chequered Flag	Psion	Spectrum
Chinese Juggler	Ocean	CBM 64
Chuckie Egg	A&F Software	BBC
Computer Wars	Thorn EMI	Vic-20
Cyrus is Chess	Psion	Spectrum
Dragonfire	Cablesoft	Dragon
Flight Simulation	Psion	Spectrum
Hobbit	Melbourne House	Oric
International Football	Commodore	CBM 64
Lunar Vic 20	Ultimate	Vic-20
Manic Miner	Software Projects	Spectrum
Maze Death Race	PSS	ZX-81
Mushroom Mania	Arcade	Oric
Space Shuttle	Microdeal	Dragon
Stonkers	Imagine	Spectrum
Twin Kingdom Valley	Bug Byte	BBC
Zaxxon	Centresoft	Atari

OK Mugsy we've put Sherlock Homes on your tail so watchout

MELBOURNE HOUSE'S staff went crazy when Manic Miner came out last year — "we lost a week of programmer time when that came out" confesses company boss Fred Milgrom. What with that and Ultimate Play the Game's arcade style graphics Milgrom had to admit that "these games were technically far superior to what we were coming up with".

To be fair Melbourne House had produced a similar effect on the other software houses with its cult adventures like the Hobbit but Fred Milgrom is determined to get back on top in arcade games too. The first stage is to mix adventure themes with arcade graphics as in Mugsy — the gangster game Melbourne House is about to release — but meanwhile back in the company's secret base, somewhere in the Antipodes, a team of programmers are working on arcade and adventure blockbusters for release later in the year.

The company is keeping the details of its forthcoming action games close to its chest but loyal Australian Philip Mitchell "I wouldn't leave the place for anything" who wrote the Hobbit gives some clues to the adventure plans. He is just putting the finishing touches to Sherlock Holmes.

Although it uses the same language analyser as the Hobbit, Philip has made improvements so it can take sentences like "I think the vicar killed Sir Henry in the conservatory with a blowpipe," — very useful if you happen to be a Victorian detective. Philip also wants to produce a "sausage machine" to take the hard work out of adventure writing.

Shakespeare on silicon will test your English revision to the limit

IF YOU BELIVE what Penguin says the company's new computer-based Study Software is "the first truly revolutionary breakthrough in the study of literature since the invention of printing." Only time will judge whether the Study Software revision aids which are aimed at students preparing for "O" levels and CSEs prove to be more significant in human history than the invention of the blackboard or teach the mass of the population to read and write, but Penguin hopes eventually to produce Study Software for all subjects.

The first set of Penguin programs deal with six of the examiners favourite Shakespeare plays, Macbeth, Romeo and Juliet, Julius Caesar, Merchant of Venice, Twelfth Night and the first part of Henry IV. You cannot throw away your books just yet though. The program gives comments on particular themes and characters in the play, but you will have to leaf your way through to the line reference.

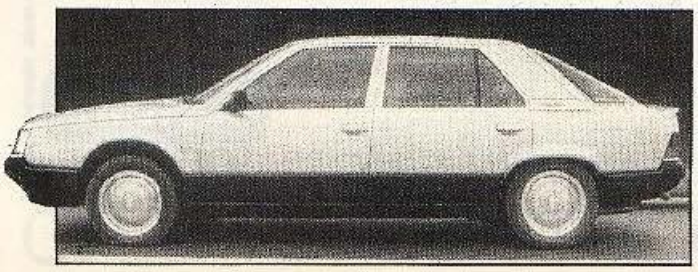
Where the Study Software beats traditional pocket guides to the plays is in its cross referencing. In Macbeth for instance you can call up any of seven main characters plus the witches, and match them with over 20 themes. you can call up Macbeth and match him with themes like Ambition, Loyalty and Treachery.

You can even cross reference different themes — like blood and water. Not surprisingly the authors are two secondary school teachers, John Mahoney and Stewart Martin. They have tried out the programs in their own classes but they stress that the Study Sofware is mainly aimed at home revision.

That is why the titles will be released first on the Spectrum at £5.95 each this month with the BBC and Electron versions to follow in May.

Geography revision is the target for TSSL's map reading program for the 48K Spectrum. The £8 program explains and then tests co-ordinates, grid references, longitude and latitude, map scaling and map key reading. Once you've mastered map reading you could always turn to John Dawson's use of computers for map writing on page 98 of this issue.

Renault's new slippery customer — the low drag Renault 25 boasts a 0.28 drag co-efficient — the lowest so-far of any production car but inside it relies on a microprocessor from the 6800 family and a ROM full of synthesised speech to justify its claim that the 25 makes "the most extensive use of electronics yet seen in a large-scale production car."



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BEGINNERS *first bytes*

Starting out in home computing? First Bytes is for you. Just write to *Your Computer* with any hardware or software problems, no matter how small or simple.

I could do that...

Tonolamatl is quite a simple programming task for home computing. You can easily code a program — according to the flow chart — which will fix a selected Aztec Name-day for a period of 13 years. Nobody but the Aztec priests could tell that in those times: The same Name-day appeared namely in different months, sometimes even twice a year. Now, your home computer will solve this Aztec Calendar problem.

Tonolamatl, or "book of the days" included 260 Name-days which were the basis of the Aztec Ritual Calendar. This Ritual Calendar was expanded by nine continuos cycles in a basic 2340 days calendar period, i.e. 6½ years.

The 260 different Name-days were a combination of a number between 1 to 13 and one of 20 days — 13 × 20 = 260.

The following 20 days formed an Aztec "month":

(continued on page 53)

Spectrum UDGs

THE ABILITY TO DESIGN and use your own graphics set is important in so many applications — arcade games, chess, chemistry and Russian come to mind. A large proportion of programs in this magazine include them.

The 7th program in the Horizons tape is "character generator". This excellent program makes it easy and fun to generate your own characters. However, the next step, learning more about UDGs, is a major hurdle. The ZX handbook does not give enough help. This article is written to give more help. The article is designed to be used at the keyboard of the Spectrum, entering the programs, and experimenting with them.

Let us suppose that the learner has used the Horizons 'character generator' to design a few interesting and potentially useful characters. First of all, it is important to understand that clearing the program by Break and New, and not by switching off, the graphics set is retained by the memory.

Suppose the symbol was stored as "Graphics A". It can be displayed by entering

```
PRINT "(Graphics) A"
```

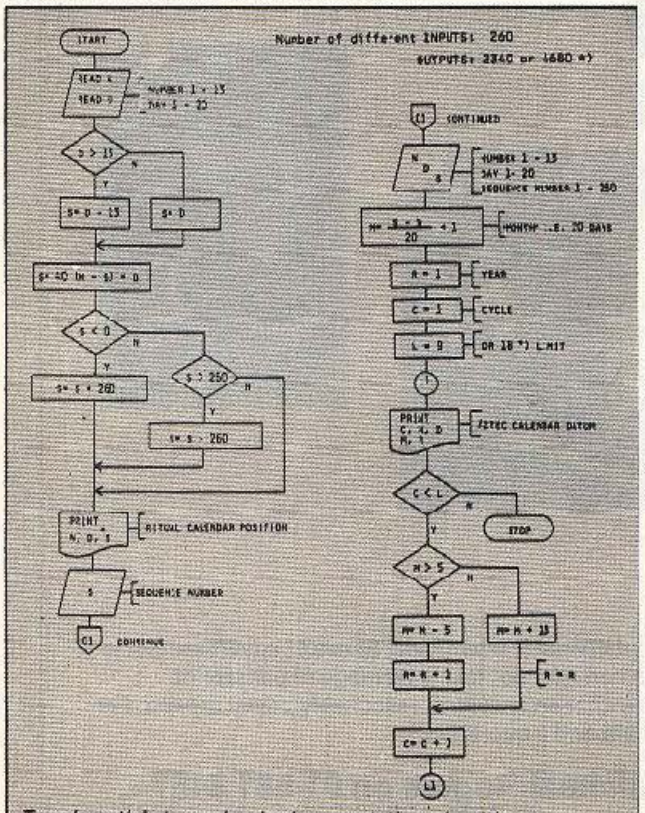
or by entering

```
PRINT CHR$144
```

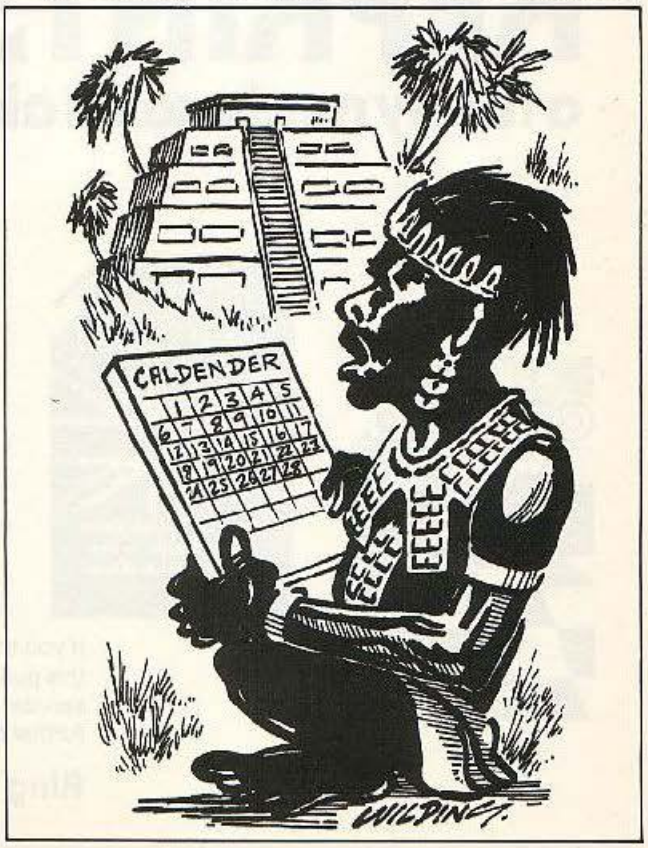
The second method is particularly important. It is used in this one-liner to print the complete graphics set:

```
1 FOR n=0 to 20: PRINT CHR$
```

(continued on page 53)



Tonolamatl Aztec calendard computation alogrithm.



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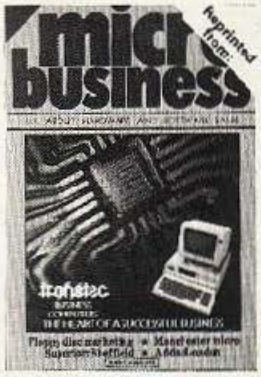

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I could do that...

(continued from page 51)

Week one	Week two
1 ALLIGATOR	6 DEATH
2 WIND	7 DEER
3 HOUSE	8 RABBIT
4 LIZARD	9 WATER
5 SERPENT	10 DOG
Week three	**Week four**
11 MONKEY	16 BUZZARD
12 GRASS	17 EARTHQUAKE
13 REED	18 FLINT KNIFE
14 JAGUAR	19 RAIN
15 EAGLE	20 FLOWER

By combining the number series and the day series, you get "One-alligator" as the name of the first day; of the second, "Two-wind"; of the third, "Three-house" — until you reach the day "Thirteen-reed". The following day is called "One-jaguar"; the next, "Two-eagle", and so on.

There were 18 Aztec "months" — 18 x 20 = 360 days — plus one anonymous week — 360 + 5 = 365 days — in a year.

If one was called Four-monkey — 4-11 — his Name-day fell in different months than his friend's who was called Three-monkey. You need a computer program to find out the Name-days. Good luck!

Nobody found February's Pascal's Triangle problem very taxing. From a large number of entries the first to be picked from the bag came from R. Nicol, 22 Hawks Park, Saltash, Cornwall.

```
10 CLS : PAPER 7: INK 0: INPUT
"Enter number of lines required
";c: CLS
20 DIM A(c): DIM B(c): LET A(1
)=1: LET B(1)=1: PRINT "1"
30 FOR a=2 TO c
40 PRINT : FOR b=2 TO a: LET A
(b)=B(b)+B(b-1): PRINT A(b-1);"
": NEXT b: PRINT "1"
50 FOR x=1 TO a: LET B(x)=A(x)
: NEXT x
60 NEXT a
```

(continued from page 51)

(144 + n): NEXT n

Before carrying on, try using this one-liner. See how it works by looking up code of the characters in the ZX Guide, page 186.

Now for the next step. Look at the PI symbol set out on page 93 of the guide. Included herewith is an expanded diagram of the symbol, with the value of each column, the Binary value of each row and also the decimal equivalent of the Binary number.

The PI symbol may be entered into the "Graphics P" location in the Spectrum's memory using program 1. When the input "r" is called for in line 80, the numbers may be entered either in decimal — e.g. 84 in the 5th row — or binary — in this case as "BIN 01010100" —You may even mix binary rows and decimal rows in the same figure being defined.

The Binary number relates quite obviously to the shape of the graphics character. To convert the Binary to decimal, add up the column values of each binary "1". So Binary 01010100 is decimal (64 + 16 + 4) = Decimal 84. Check the figure for PI, row 5, until you are quite certain that you have grasped this.

There are two things to note in connection with program 1. Firstly, you can replace line 90 by this line

90 POKE USR "P" + n,r

Secondly, you can use Read and Data to Input the rows.

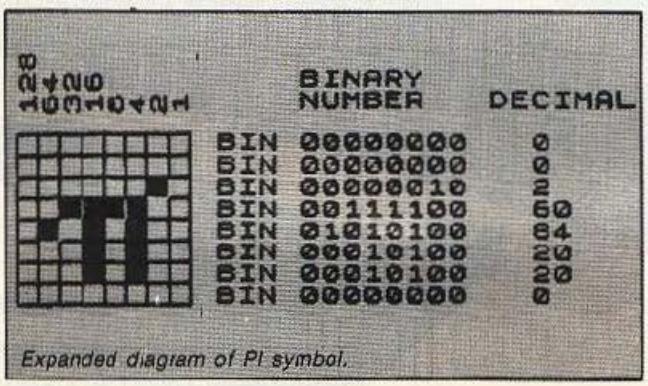
Program 2 shows how the graphics for PI can be entered into the Graphcis P location by using the Read/Data feature.

Program 1

```
10 REM "defUDG"
30 CLS: PRINT: PRINT, "Row"
40 FOR c = 1 TO 8
50 PRINT AT 3 + c,12;c
60 NEXT c
70 FOR n = 0 TO 7
80 INPUT "Next Row ";r
90 POKE USR CHR$ 80 + n,r
100 PRINT AT 4 + n,16;r
110 NEXT n
120 PRINT: PRINT TAB 12;CHR$
80;CHR$ 159
150 STOP
9990 SAVE "defUDG" LINE 10
```

Program 1a (to add to program 1)

```
10 REM "defUDG"
20 FOR m = 0 TO 20
90 POKE USR CHR$ (65 + m) + n,r
120 PRINT: PRINT TAB 12;CHR$
(65 + m); CHR$ (144 + m)
130 INPUT "Press ENTER to
continue ";Z$
140 NEXT m
```



Expanded diagram of PI symbol.

BEGINNERS *first bytes*

Program 2

```
10 REM "defUDG"
20 FOR n = 0 TO 7
30 READ a
40 POKE USR CHR$ 80 + n, a
50 NEXT n
60 PRINT "Graphics "; CHR$ 80;"
   gives U.D.G. ";CHR$ 159
70 DATA 0,0,2,60,84,20,20,0
80 STOP
```

So far, entering a single character has been considered. A complete set may be entered by adding the lines of program 1a to program 1, or by using program 3, in which the Data lines — starting at line 70 — will yield the graphics set I wrote for a few Chemistry programs.

Program 3

```
10 REM "defUDG"
20 FOR m = 0 TO 20
30 FOR n = 0 TO 7
40 READ a
50 POKE USR CHR$ (65 + m) + n,a
60 NEXT n
70 NEXT m
80 DATA 24,36,36,36,24,0,0,0,2,4,
   36,8,16,60,0,0,0,56,4,24,4,56,0,
   0,0,0,0,0,24,36,36,36,24,0,0,0,
   24,36,8,16,60,0,0,0,56,4,24,4,56,
   0,0,0,32,32,40,50,8
90 DATA 0,0,0,60,32,24,36,24,0,0,
   0,16,32,56,36,24,0,0,0,60,4,8,8,
   8,0,0,0,24,36,24,36,24,8,8,62,8
   8,0,0,0,0,0,60,0,0,0,0,0,0,28,16,16,
   16,16,16,16,28,56,8,8,8,8,8,56
100 DATA 0,4,2,255,0,255,64,32,0,0,
   0,0,108,146,108,0,0,0,28,32,120,
   32,28,0,0,8,10,18,34,66,231,0,0,
   231,68,120,68,66,231,0,0,8,20,
   20,34,62,0,0
110 CLS: PRINT TAB 3;"CHR$" TA
   B 11; "Graphics"; TAB 23;
   "U.D.G."; PRINT
120 FOR b = 0 TO 20
130 PRINT TAB 3; 144 + b; TAB 15;
   CHR$ (65 + b) TAB 23; CHR$
   (144 + b)
140 NEXT b
150 STOP
```

By this stage, you may have wondered about reading a graphics set, such as those you may have generated using the Horizons character generator. Program 4 does this, dismantling my chemistry graphics set.

Program 4

```
10 REM "UDGlist"
20 FOR m = 0 TO 20
30 PRINT CHR$ (65 + m); TAB 2,
   CHR$ (144 + m);
40 FOR n = 0 TO 7
50 PRINT TAB 5 + 3*n;PEEK
   (USR CHR$ (65 + m) + n),
60 NEXT n
70 PRINT
80 NEXT m
90 STOP
9990 SAVE "UDGlist" LINE 10
```

Program 4. Printout.

```
A  ?  24 36 36 36 24 0  0  0
B  @  24 36 8  16 60 0  0  0
C  A  56 4  24 4  56 0  0  0
D  B  0  0  0  24 36 36 36 24
E  C  0  0  0  24 36 8  16 60
F  D  0  0  0  56 4  24 4  56
G  E  0  0  0  32 32 40 60 8
H  F  0  0  0  60 32 24 36 24
I  G  0  0  0  16 32 56 36 24
J  H  0  0  0  60 4  8  8  8
K  I  0  0  0  24 36 24 36 24
L  J  8  8  62 8  8  0  0  0
M  K  0  0  60 0  0  0  0  0
N  L  28 16 16 16 16 16 16 28
O  M  56 8  8  8  8  8  8  56
P  N  0  4  2  255 0  255 64 32
Q  O  0  0  0  0  108 146 108 0
R  P  0  0  28 32 120 32 28 0
S  Q  0  5  10 18 34 66 231 0
T  R  0  231 68 120 68 66 231 0
U  S  0  8  20 20 34 62 0  0
```

The final problem is how to save and use your UDG set. This depends on whether you have a 16K or a 48K Spectrum. I think it is rather wasteful to use a Read/Data structure to re-define a graphics set each time, and use this approach.

Suppose you have a UDG set in your memory. You may, for example, have entered and run program 3, Newed it, and entered program 4 to dismantle it. New to clear the program, without switching off.

Next, enter program 5 without typing in line 9000. Run the program, which displays the graphics set, and then add line 9000. Be sure to use the correct codes in lines 9000 and 9995. The program and the graphics set are Saved in two sections by Goto 9990 — and Enter. Watch for the second "start tape then press any key" message. The program will auto-start — again in two sections — by simply Load"".

The lines between 10 and 8999 are available for any program you like to write, using the UDG set.

Program 5

```
10 REM "UDG48"
20 PRINT" User Defined
   Graphics
30 PRINT: PRINT " CHR$
   Graphics U.D.G."; PRINT
40 FOR n = 0 TO 20
50 PRINT TAB 3; 144 + n;
   TAB 15; CHR$ (65 + n);
   TAB 25; CHR$ (144 + n)
60 NEXT n
70 STOP
8010 GO TO 10
8990 SAVE "UDG48" LINE 9000
8995 SAVE "UDG48" CODE
   65368,168
```

With graphics set in this memory, Run program 5 without line 9000. Now add line 9000, and the demo program is ready to Save by Goto 9990.

```
9000 LOAD "UDG48" CODE 65368
```

For 16K Spectrum, substitute

```
10 REM "UDG16"
9000 LOAD "UDG16" CODE 32600
9990 SAVE "UDG16" LINE 9000
9995 SAVE "UDG16" CODE
32000,168
```

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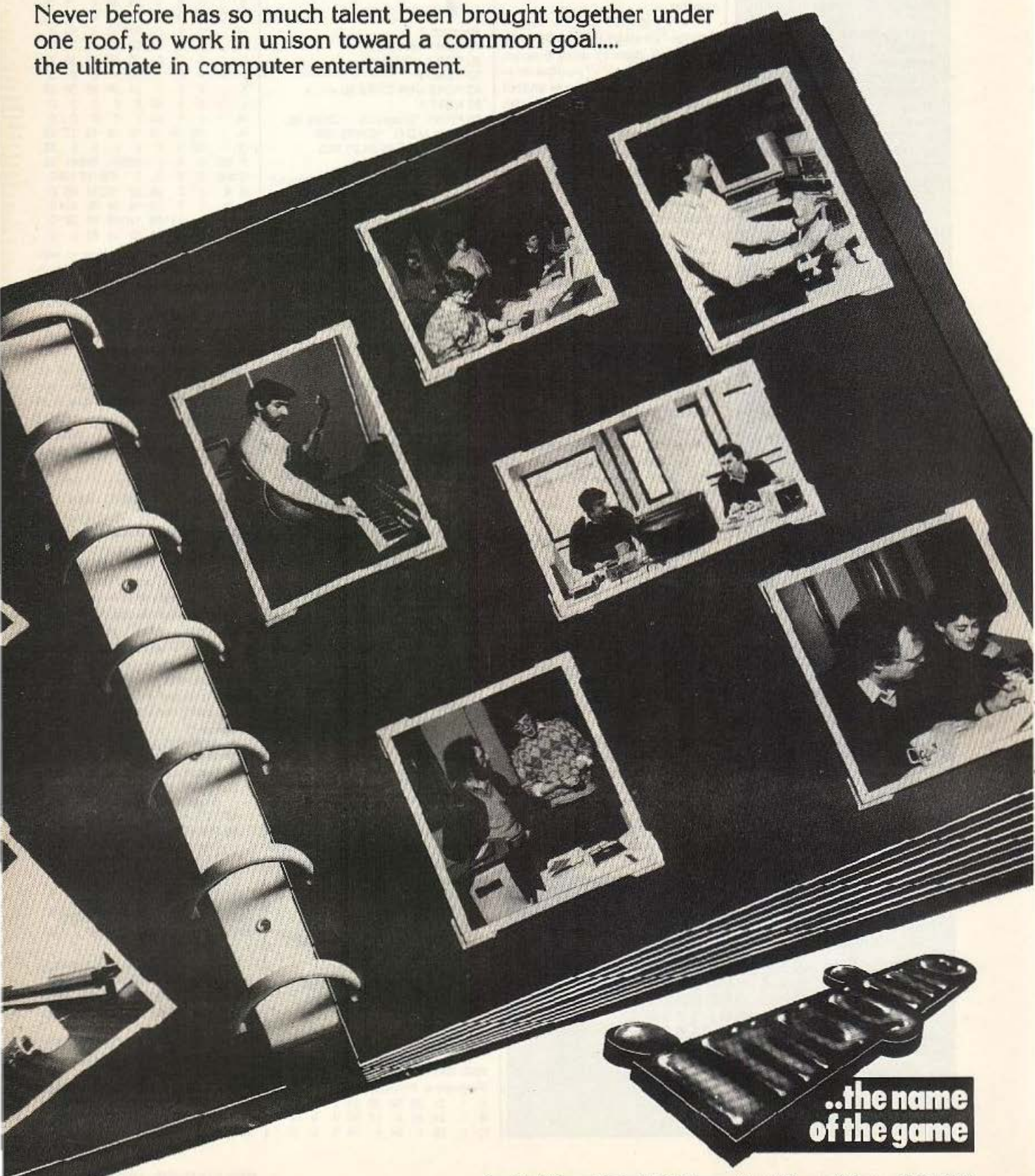

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Local news

Stoke on Trent

The Mixed Bytes Computer Club meets at Dilhorne Recreation Centre, New Road, Dilhorne near Stoke-on-Trent every other Thursday between 7.30 and 9 p.m. All users are welcome. Call Mr A Cope on 0782-396003.

Long Eaton

The ZX Spectrum Club in Long Eaton, Nottingham, is a non-profit making organisation dedicated to the care and rehabilitation of Spectrum owners. For more details contact P Riley, 63 Kingsley Crescent, Sawley, Long Eaton, Nottingham NG10 3DA.

Arun

Arun Microcomputer Club gets together at Wick Amenity Centre, Littlehampton, West Sussex on the first Monday of every month at 8 p.m. and the third Sunday of every month at 6 p.m. Contact P Cherriman, 7 Talbot Road, Littlehampton, West Sussex DN17 7BL. Telephone 09064-7807.

Shrewsbury

Shrewsbury Micro Club meets at Shrewsbury Shirehall once every two weeks. Contact Mr V Ives, 6 Bramley Close, Severn Meadows, Shrewsbury. Telephone: 0743-55024.

Mid-Kent

The Mid-Kent Micro Club has freed itself from association with the TRS-80 and all computerniks are now welcome at the Maidstone Teachers' Centre, Sittingbourne Road, Maidstone between 7 and 10.30 one Friday a month. Contact M K Gates at 65 Buckland Road, Maidstone, Kent.

COMPUTER club

Paul Bond visits Guildford to find out what computers offer in the way of aids to the handicapped.

A NEW VENUE — THE Stoke Hotel, Stoke Road, Guildford — may have thrown a few members but nevertheless there was a good turnout when *Your Computer* visited the West Surrey Computer club recently. The evening was dedicated to micros in the service of the disabled as club chairman Fred Tickle explained.

Tony Isles from the Foundation for Communication for the Disabled started the evening off by demonstrating applications for the Microwriter. This is a hand-held keyboard with liquid crystal display and 8K onboard CMOS RAM which was originally designed some years ago as a king of high-tech notebook not specifically aimed as the disabled.

The Microwriter uses a five-key system to generate text; you have to learn different combinations to generate different characters. This is of obvious use to someone whose handwriting is getting spidery and shaky — as in the case of a multiple sclerosis sufferer. But versions have been developed which do not even require hands. Mr Isles demonstrated a Microwriter controlled by breathpower. Lights in place of buttons on the keyboard indicate what notional buttons are being pressed; when you release the mouthpiece, the letter comes up on the LCD.

This means children with disability can be integrated in normal schools because they have a means of writing that they can carry around with them and which is independent of the mains supply, unlike the bulky electric typewriters that they are often forced to use.

An interesting application of computerised voice synthesis which benefits blind people was also demonstrated.

They can play their Microwriters into a voice synthesiser which can either spell, or read out what they have keyed in. Future developments include bigger program dictionaries so that the machine will be able to pronounce words like "Wednesday" as we do, rather than separating each syllable.

Peter Bell put the emphasis on education. He teaches at the Lord Mayor Treloar College, a school for handicapped in Alton, Hampshire. While many of this 250 pupils make use of Microwriters, they don't solve everything. Some youngsters are not highly-motivated enough to learn the codes. Another system used is the MacApple computer — an Apple with special software which allows you to use the whole keyboard, part of it, or just one button as a scanning device.

Above: demonstrating a Microwriter adapted for breath control. Left: the BBC Visispeech set-up for deaf speech education.

One child with speech disability was experiencing considerable difficulty in writing — a line of typewriting might be his entire output for the day, leaving him exhausted. Communication with the outside world was a real problem. Using the MacApple, together with a joystick, instead of his expanded keyboard connected to a typewriter by failure-prone solenoids and wires, he generated so much text on his first day of use that he had to be held down; he was so excited.

Some time ago, the school was involved in a study rather like *Your Computer's* "Design a Micro" competition — ideal for their purposes, they decided, would be a portable battery-powered, CMOS-based computer with LCD display and built-in printer. Coincidentally, Epson brought out the Epson HX-20 just as they finished, and it was pretty much what they wanted. This enables pupils to communicate and to take notes in classes.

John Piper, from Tools for Living, a Welsh-based organisation contactable on 0437-83472, pointed out that we're all one-fingered typists at heart. He showed an ergonomically-designed keyboard designed to reduce the number of repetitive moves, built by PCD Maltron Ltd.

Typing with one finger is all very well, but however fast you do it, being able to generate one word with one movement is still much faster. Clive Sinclair's Spectrum came in for some praise with its keyboard system — but you still need two fingers to operate it. A similar device for people with communication problems has been developed by Guy Hamilton, a doctor from Woking.

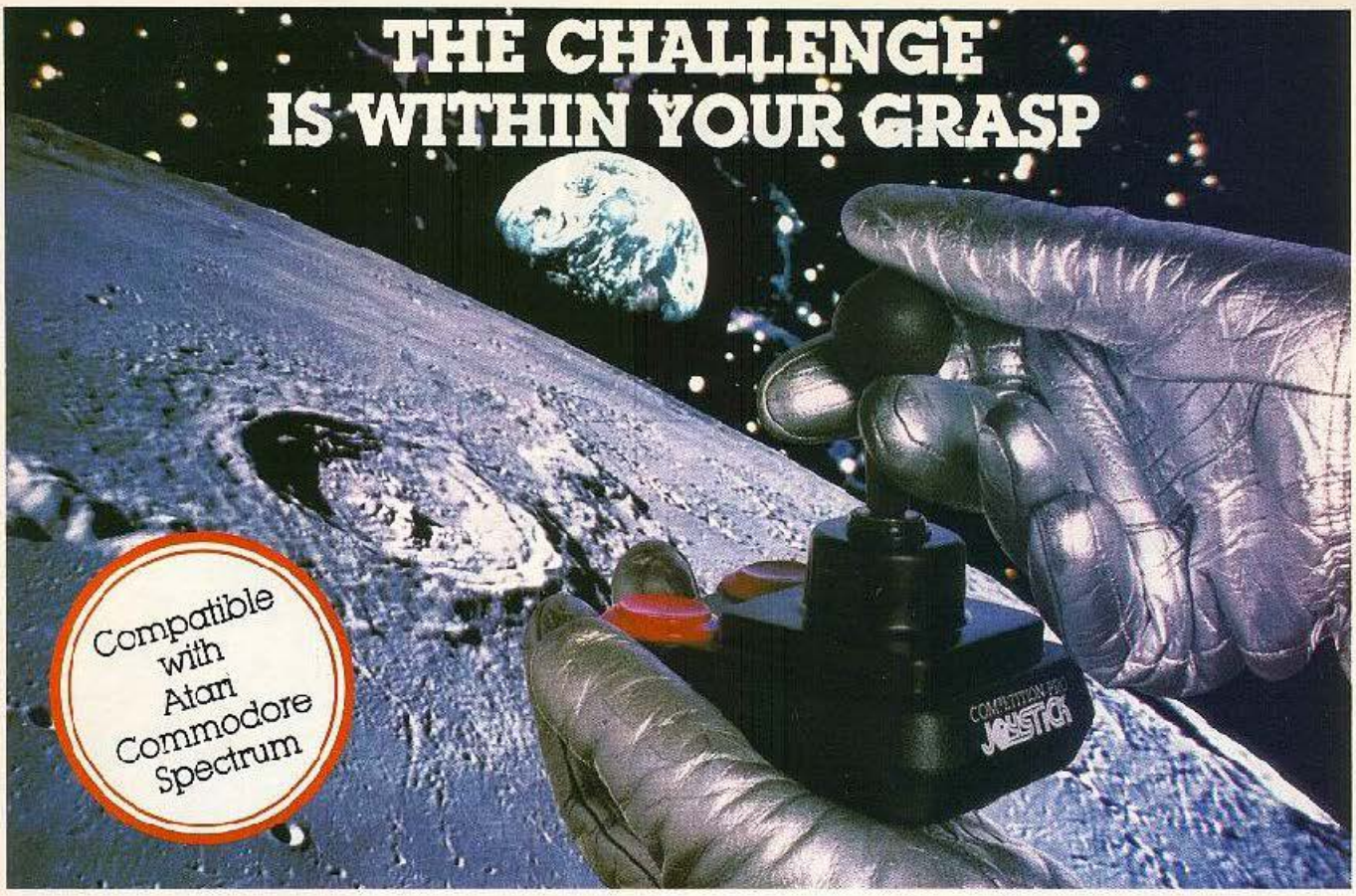
This is a big 2ft by 3ft pressure pad board with 800-1000 keywords written on it. The Splink, as it is known, can be hooked to a VDU via an infrared link like a remote control TV unit. This obviates cables lying around in an environment where there are probably enough people with mobility problems anyway.

Mr Piper also demonstrated a system employing the BBC Micro to teach deaf people how to modulate the sound that comes out of their throats. Because deaf who have been deaf from birth cannot hear what they are saying, their speech may sound strange to non-handicapped people.

The BBC can be used as a source of feedback. Using a £900 Visispeech interface, an oscilloscope pattern is generated on the screen by vocal inputs. The deaf person can then try to achieve the same pattern underneath that created by the teacher.

The West Surrey Computer Club, whose secretary, Chris Karney, can be contacted on Guildford 68121 Ext 587, has many such informative evenings lined up.

THE CHALLENGE IS WITHIN YOUR GRASP



With the vast range of games now available for home computers each holds a different challenge. Now there are three Competition-Pro Joysticks in the Kempston range that will come to your aid and improve your playing capabilities. Your movements will become quicker, with finger poised over the fire button at the ready, your scores will be out of this world. Playing will be so much easier! If you're serious about the challenge your computer presents then you shouldn't be without a Kempston Competition-Pro Joystick.

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Some games you can buy were produced before Joysticks were available for the ZX Spectrum. With the aid of Kempston conversion tapes these games can now be played with any of the Kempston range of joysticks.

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Star chart

Dambusters
BBC B:
Bomb it down:
£7.95:
Alligata:

★ ★ ★ ★ *Plus 5 raspberries for lack of information on availability of disc version or possibility of swapping*
Great fun and rather unpredictable vers on of W.W.I Dambusters exploits, Rathol simular graphics to defender (planetoid) but good and simple. Also good sound with external speakers.

Vortex
BEC B:
Shoot-'em-up:
£7.95:
Software Invasion:

★ ★ ★
This 3D in 2D game (no red and green glasses) has an inevitability about it that makes you try harder even though you know that failure looms! Unusually I found that both the joystick and keyboard gave good control of the fighter craft equipped with laser torpecoes.

Pengwyn
BEC B and Electron (see note):
Novelty:
£6.95:
Postern:

★ ★ *Plus 5 raspberries for lack of information on availability of disc version or possibility of swapping.*
Moving blocks of ice, crushing nasties and trying to align special blocks leaves me chilly.

Hicksted
Spectrum 48K:
Games for Girls':
£5.95:
CCS:

★ ★
Hicksted, is a game of computer sed horsemanship based on the differently spelt show jumping ground Hickstead. It is one of three games under the somewhat dubious category of 'Games for Girls' I thought it best if I got a little horse mad, computer crazed friend of mine to review it. She was to put it mildly disappointed. Conclusion: a great idea executed poorly.

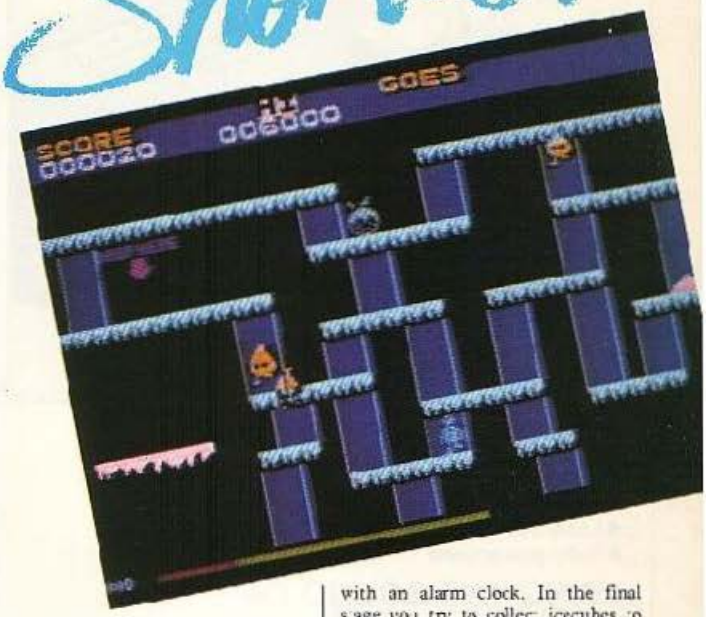
SOFTWARE Shortlist

Snowman
■ *Spectrum 48K*
■ *£6.95*
■ *Quicksilva*

★ ★ ★

THERE'S NO PEOPLE like snow people, and the Snowman, based on the book by Fungus the Bogeyman creator Raymond Briggs, is already noised abroad as unique among computer games for its non-violence. At last a game that parents can buy for Junior secure in the knowledge that they will not awake next morning to find their lovable offspring transformed into a bloodcrazed twitching freak.

Instead of dying in the Snowman, you go to sleep. The screen display is a frosty blue, ladders and levels display. You have to collect six pieces of snow in order to build the snowman. Watch out for roving gas flames — these melt the snow you are carrying, and it reappears elsewhere on the screen. This game will appeal to perverse people who insist on celebrating Christmas in the middle of the summer, since you gain extra points for collecting various Christmas crackers, presents, stockings and trees. If you collect an ice lolly you can ward off the gas flames. Your energy is replenished by eating a turkey or Christmas pudding.



In stages two and three you have to kit out the snowman with scarf, hat, nose etc while avoiding the Sleep Monsters. These can be neutralised with an alarm clock. In the final stage you try to collect icecubes to stop your snowman from melting. The gas flames make their comeback here. Attractive graphics, well thought-out idea, perhaps a little too much dexterity required to position your man at the bottom of ladders

Blue Thunder
■ *Spectrum 48K*
■ *£6.95*
■ *Richard Wilcox Software*

★ ★ ★

NOTHING TO DO with the film starring Roy Scheider, or the TV series starring James Farentino; in this program we are a world away from the difficulties of community policing by helicopter. You are probably better off playing this game with a joystick, than the keyboard, but even then the fire button is given the three functions of 90, 180 degree turns and firing. This can complicate

(continued on page 59)

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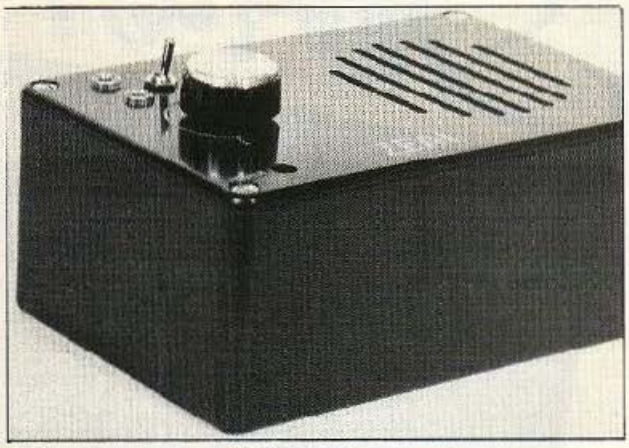

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AUTO	— for automatic entry of line numbers.
CLOCK	— controls a digital clock with alarm and alarm-initiated GOSUB facility.
DELETE	— any block of lines.
DO	— DO. . .LOOP structure, with WHILE, UNTIL and EXIT IF.
DPOKE	— double POKE.
EDIT	— a specified line number.
ELSE	— used with IF . . . THEN.
GET	— waits for keyboard entry, doesn't use ENTER.
KEYWORDS	— shifts between new keywords and normal graphics mode.
ON	— GOSUB or GO TO a line number from a list of line numbers.
ON ERROR	— allows trapping of most reports; has available ERR, ERL and STAT variables.
POP	— removes data from BASIC's stack.
PROC	— named procedures, with DEF PROC and END PROC.
RENUM	— renumber part or whole program with specified start line and increment. Handles GO TO, GOSUB, ON, etc.
ROLL	— pixel movement of part or whole screen in any direction, with wrap-round.
SCROLL	— as ROLL, but without wrap-round.
SORT	— sorts part or all of string or numeric arrays according to specified substring or column. SORT" INVERSE sorts in reverse order. One hundred strings can be sorted in about one fifth of a second!
TRACE	— allows display of line and statement numbers as a program is running. Display of selected variables, single stepping, and reduced speed are also possible.
USING	— used with PRINT, formats numbers.

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Star chart

Starship Escape

Vic-20 with 16K expansion:
Maze shoot-'em-up:
Sumlock:
£7.95:

★ ★

A tractor beam drags you aboard the alien ship. Your craft is dismembered and you must prowl about the eerie craft reassembling your own vessel. Ardroids, robots, space spiders and the ever-watching Force Cloud make life difficult. Playable with joystick or keyboard. You zoom around the space-hulk at great speed, infuriatingly being re-imprisoned where you started from with your trusty K9 friend. Graphics not marvellous, of course.

Destroyer

Unexpanded Vic-20:
Shoot-'em-up:
Sumlock:
£7.95:

★ ★ ★

An unembellished shoot-'em-up, requiring plenty of co-ordination, nevertheless. Using the keys you have to steer your destroyer back and forth on the oggin, shooting to left and right at attacking aircraft, depthcharging submarines, and dodging torpedoes and bombs. The whole game runs for a time period shown by a changing strip at the bottom of the screen. If you survive the time period, a bonus based on planes downed is added to your score. Not bad in 3K.

Bull Run

16/48K Spectrum:
Run away:
Phipps Associates:
£6.95:

★

Silicon Pamplona. On holiday in a Spanish village you are pursued by a wild bull. There is a 30,000 pesetas reward from which 50 is deducted every second. You use yourself as bait and put up fences. These do not stay up very long. The Bull will gore you if you are carrying a fence, but you are fairly safe behind one. Three levels of play, not great graphics, cheaper than a holiday in Spain.

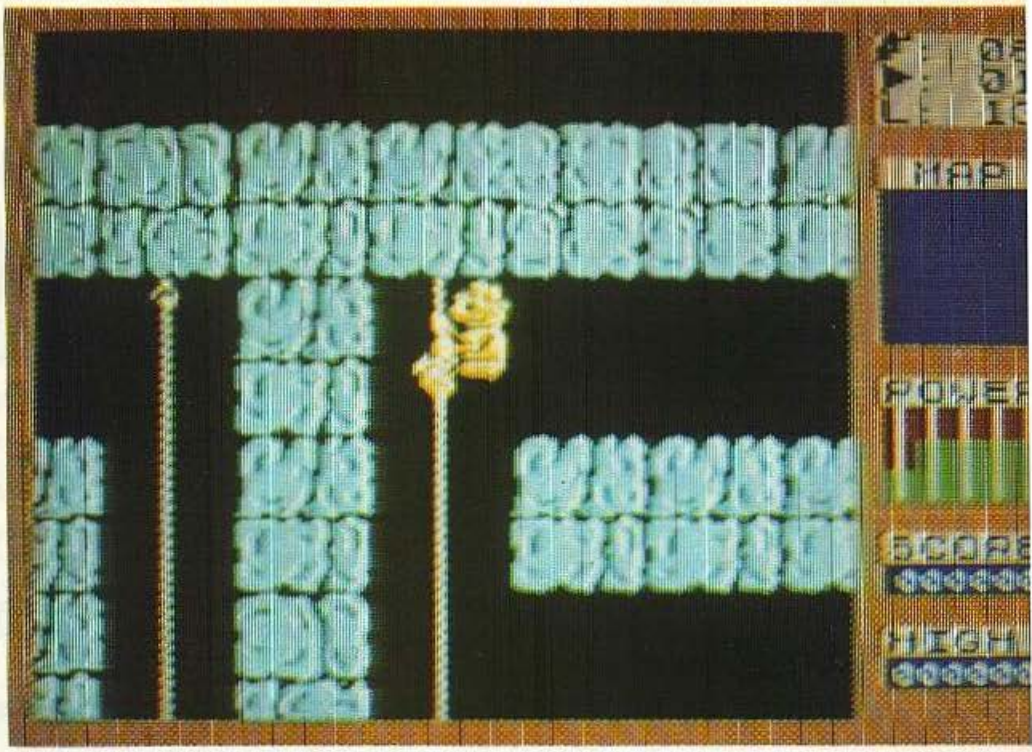
SOFTWARE Shortlist

(continued from page 57)

matters. I am also dubious about the claim of incredible perspective graphics.

This is a pretty Choplifter with a nuclear reactor thrown in. First, pilot your whirlybird. Off the VSTOL carrier over the islands, getting shot at. There are five different levels of difficulty. In the higher levels you contend with waves of jet fighters and indestructible red balloons. Only one of the latter at a time — the number never gets as high as 99. You penetrate enemy lines, destroy the nuclear reactor and rescue up to 16 comrades in one trip.

The on-screen score line displays from left to right, reserve etcopters, current score and mission number. A vertical bar on the right of the screen indicates your chopper's fuel level. A challenging game.



Neptune's Daughters

- *Commodore CBM-64*
- *£7.95*
- *English Software*

★ ★

As the old pre-decimalisation jokes goes "My girlfriend's a mermaid — lovely vital statistics: 36,24 and four and six a pound." Your history teacher might be able to explain it to you. The aim of this game is to rescue Neptune's beautiful daughter from the sea serpent who is holding her captive. Unfortunately we have to admit this game had us pretty well stumped. It is either a very demanding and challenging game, or impossible to play and consequently stupid, depending on who you talk to.

Either way, Neptune's daughter never showed up for any of us, and it is a lot of bother fighting octopuses, sucker plants and deadly amoebae just for a blind date. You take the part of an acquaman who absorbs oxygen through his gills. You have to fight off the attentions of poisonous octopodes and clear the way of deadly sucker plants to get through to successive caverns in this Submarine Scramble scenario. You eventually encounter amoeba swarms, you have to manoeuvre yourself into a position where you can kill them with your harpoon and absorb the bubbles of oxygen which they emit as they die.

This is as far as most of us could get. Apparently after this a monster crab is encountered. You kill this and take it with you to feed the sea serpent. All being well, the gorged ophiuchan ogre will knock off for 40 winks while you depart with the girl in the wet-look outfit. You then lead her back to the safety of the palace, where presumably you can settle down to discuss the experience over half a shandy and a packet of shrimp-flavoured crisps.

This is all hearsay, however: one thing we can say — this game has a very high frustration quotient.

Fred

- *48K Spectrum*
- *£6.95*
- *Quicksilva*

★ ★ ★ ★

From the people who brought you Bugaboo or Booga-boo, depending on which computer you play it on, comes another feast of Disneyesque graphics.

The screen display presents you with a vertical maze of glowing blue stone walls, around which the intrepid Fred wends his weary way in search of the treasures of the Pharaohs. Yes, I know we have done the Pharaohs at the bottom of your garden joke.

Fred shins up and down ropes, avoiding contact with rats, acid drops, ghost which can go through walls, chameleons, mummies and vampires. He has a gun and six bullets.

There are six screens, increasing in difficulty, followed by the option to return to the first screen, or redefine the maze and number of monsters.

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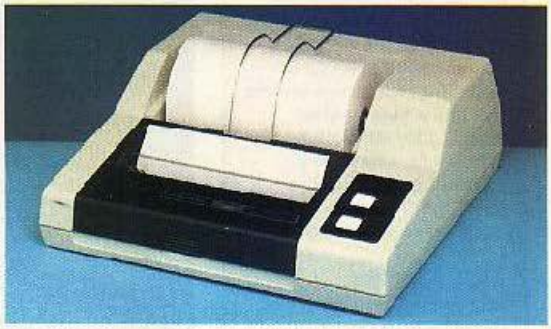

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NEWS oaeo rssu tttt h h

The crystal ball

Giving the crystal orb a good shake reveals two new adventures from Software Projects of Liverpool. The first, Legion, is for the BBC B and takes place at the time of the Roman Empire. McKensie is the second and has you playing the role of a famous space explorer who has been captured and imprisoned on a pirated space station. You will need a 48K Spectrum to play it.

Lothlorien, perhaps better known for its war gaming programs, has launched a series called adventure Master. The first in the series is an Arabian Nights type fantasy entitled The Stolen Lamp. It is a text and graphics adventure for BBC B owners.

Another text and full pictorial adventure for the BBC B and Commodore 64 micros is Twin Kingdom Alley, a large and complex adventure from Bug-Byte.

A helping hand

Calling all fans of Level 9 Computing's Colossal Adventure. Are you baffled by a certain bridge-blocking Troll? See below for a clue that will enable you to pass free of charge.

Attention all Scott Adams Pirate Adventurers. Could be you are stuck at the second treasure. Help is at hand below. As usual, the clues are written backwards to avoid the eyes of the unwanting unwary. Let us hear from you about other problems you are having — I will do my best to help in these pages.

Troll trouble:

RETAL MEHT EVEIRTER OT DROW CIGAM YAS: LLORT OT SGGE NEDLOG EVIG

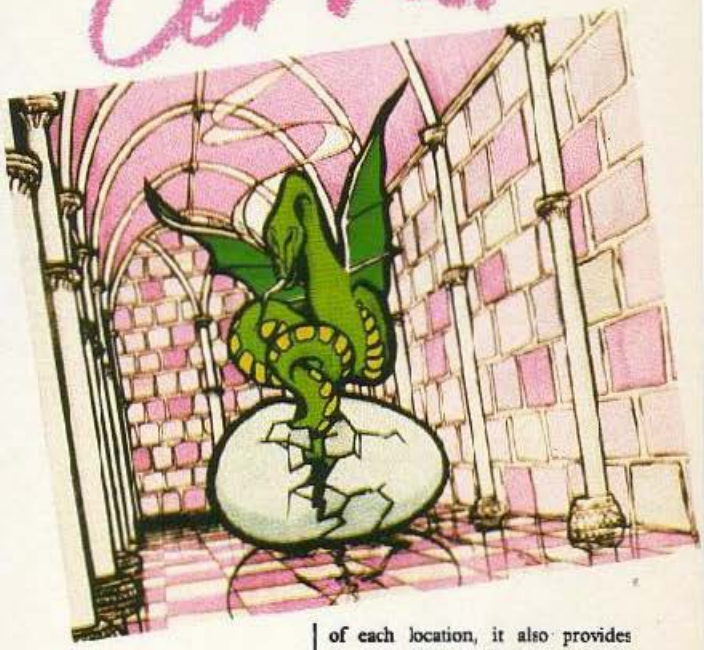
Pirate treasure:

GID NEHT 03 ECAP,DLEIF EHT NI

Happy hunting!

QUEST Quest

Our man with the brass lamp and the key to a thousand mysteries sheds light on new adventure programs. Lost? Never fear, Hugo North is here.



Kingdom of Hamil

- BBC B
- £9.95
- Acornsoft

KINGDOM OF HAMIL is the latest puzzler to join the illustrious band of Acornsoft adventures for the BBC B Micro. This group now includes such brain bafflers as Philosopher's Quest, Sphinx Adventure, Castle of Riddles and Countdown to Doom — enough mind-bending puzzles to keep you occupied for the rest of this year.

Like the other Acornsoft adventures, Kingdom of Hamil is text only, commands being input in the normal verb and noun format. Each location is described in detail on your visit but thereafter in brief — unless you specifically request the full description with the command Look.

Some of the commands recognised by the program are detailed on the cassete box; it is up to you to find out the rest while playing.

You always wondered why you had blue blood in your veins when all your friends had common or garden red. Now you have learned why — you were stolen from your royal parents, the rulers of Hamil, as a child. It is up to you to prove your identity and claim your birthright, but watch out — you seem to have made an awful lot of enemies when you were a baby.

The adventure starts with you trapped inside a chapel. Venture outside and a 16 ton weight drops on your head, ending your assault on the throne before it has begun.

Some adventures have plenty of locations but precious little in the way of objects, dangers and puzzles. Kingdom of Hamil has them all, in spades.

Heroes of Karn

- CBM-64
- £7.00
- Interceptor Micros

HEROES OF KARN is a Commodore 64 adventure of the classic mode but in modern dress. Not only does this text-based fantasy give you an attractively drawn coloured picture of each location, it also provides some very impressive music into the bargain. As you might expect in a classic adventure, there's quite a bit of treasure needing to be collected but that is not the main purpose of your mission.

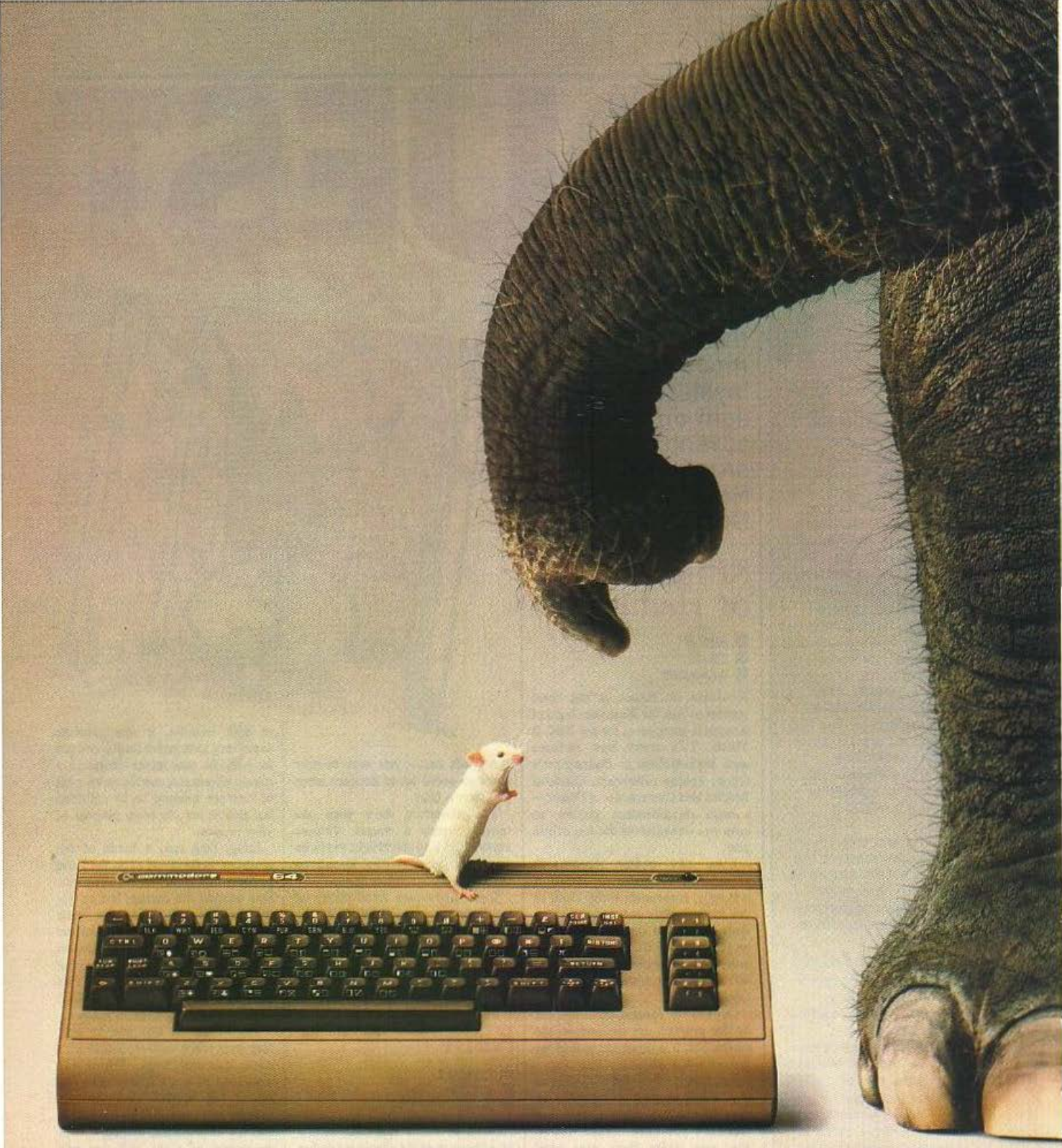
Long, long ago, a horde of fell creatures swept down upon the Land of Karn, and great was the slaughter. Few escaped the carnage but among the handful that did were four Heroes of Karn: Beren, lord of the birds of the air and swordsman supreme; Ista: the Wise, master of magic and lore; Haldir, greatest of all minstrels; and Khadim the Dwarf, small in stature, mighty in renown.

Yet, eventually and one by one, they were taken captive, bound with stone, iron and magic. Where and what they now are is unknown but legend has it that one day the stranger will come, will venture forth into the dark Lands, will fight with the powers of night, will find and release the long-imprisoned heroes.

That day has dawned — you are that stranger. Can you fulfil your destiny?

If you can, I guarantee you will not do it quickly. There are over 65 locations to seek out and explore, and over 30 puzzles to solve. Much of the adventure is linear — that is, some problems can only be solved by overcoming earlier ones. This makes it a shade tougher than some others and should give your mental powers a real workout.

Heroes of Karn is a first-rate adventure providing a great deal of pleasure. the musical passages are a delight — turn up your volume for the best effects.



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REVIEW

After the first false dawn, Kathleen Peel finds out if real keys can help Radofin succeed where Mattel failed.

CONTINUING THE recent fashion of repackaging an existing low-price computer by fitting it with a proper keyboard, the Aquarius II succeeds the ill-fated Aquarius. At £80 it becomes the cheapest real-keyboard computer currently in production.

The misgivings regarding the original Aquarius, apart from the keyboard, were in the limited resolution of the colour display, poor Basic, virtually non-existent editing facilities, high price of peripherals and very limited software. Combined, these led to a general panning of the computer.

The revamped Aquarius competes with the Spectrum, Tandy MC-10 and Laser — the Laser may not now be on sale due to the demise of Computers for All — and fills the gap left by the discontinuation of production of the Oric 1 and the real keyboard computers, the Vic-20 and the TI-994A.

The review model is a preproduction version of the Aquarius II and there may be some minor detail changes to the finished product. As the standard of the review model is very high with a clean PCB without changes, I presume any changes will be in ROM and cosmetic.

The new keyboard makes a tremendous difference to the Aquarius. Although not elegantly styled, it is very good. As I like computers to have both keyword and fully typed entries, the Aquarius gets a definite plus here. My only criticism of the keyboard is that some users like an audio feedback and the computer does not provide this facility.

The Aquarius comes in a Basic 4K which leaves 1,652 bytes free for your programs — not much but a 16K RAM pack at £30 and 32K RAM pack are available.

More memory or a games cartridge can be plugged into the expansion slot. Further expansion is via a mini expander which adds two joysticks, a cartridge and a memory port and costs £40.

The Aquarius II can use the peripherals designed for the first Aquarius, and the manufacturer of these micros states that the Aquarius III, due for release in the autumn, and the Aquarius IV under development, will also be fully compatible with all peripherals and software.

The printer interface is RS-232C, but does not allow for two-way computer traffic; a pity really as it would have been useful to be able to network the Aquarius. Because the interface is RS-232, it should be possible to use any other printer providing it is capable of running at 1,200 baud.

The display was quite reasonable with little dot crawl, but surprisingly for a computer from the Far East, there is no video output.

A reset key is provided next to the on/off switch. This allows a warm start when followed by Control and C.

The Aquarius II is identical in operation to the original Aquarius with the Extended Microsoft Basic cartridge. This provides several improvements, the most significant of which is the implementation of an editor.

The editor has some very nice search facilities, but also some rather annoying anomalies although in use I soon became accustomed to the fact that once you have gone past a position in a line you cannot go back to edit further, you must restart the line.

The ability to search a line for the nth occurrence of a character was impressive and would have been even more so if the multi-statement lines were not limited to 72 characters.

The editor commands are:

- I insert
- X go to end of line
- L list rest of line and restart
- nD delete n characters, default 1
- H delete to end of line
- nC change n characters
- E save changes
- Q ignore changes (quit)
- A abort current changes
- nS char — search for nth occurrence
- nK char — delete n chars in line

The tape interface worked without many problems and is adequate for speed. A purpose-built tape recorder is available with built-in record and playback levels suitable for the Aquarius. But using a three- or five-way DIN with 3.5mm. plugs the Aquarius can be used with any cassette recorder.

The 4K RAM is used to store the display, colour attributes and a few system variables: the user is left with 1,652 bytes for a program.

The ROM is inaccessible in normal usage. This will prevent the more adventurous user from exploring the insides of the Aquarius and can only lead to a delay in the provision of quality, independent, low-cost tape software.

The Microsoft Basic is faster than the Spectrum, timing tests are given in figure 1.

Figure 2. Draw macro commands.

```
Ok
LIST

10 CLS
20 F$="bm50,50l30u25r30d25"
30 W$="BM-20,-15 LS U5 R5 D5"
40 D$="bm-5,-5r8d19bl8ul5"
50 R$="bm-18,-6m+15,-15m+15,15
60 DRAW"s2"
70 DRAW"xF$;xW$;xD$;xR$;
80 DRAW"s4"
Ok
COPY
```

Figure 3. Aquarius printer character set.

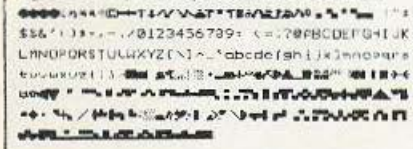


Figure 4. An indication of the pixel resolution available on the Aquarius II.

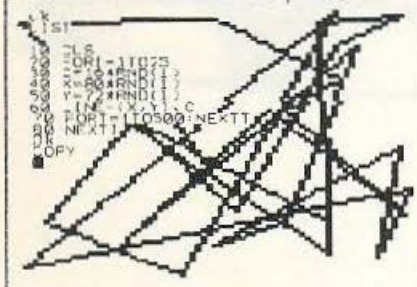
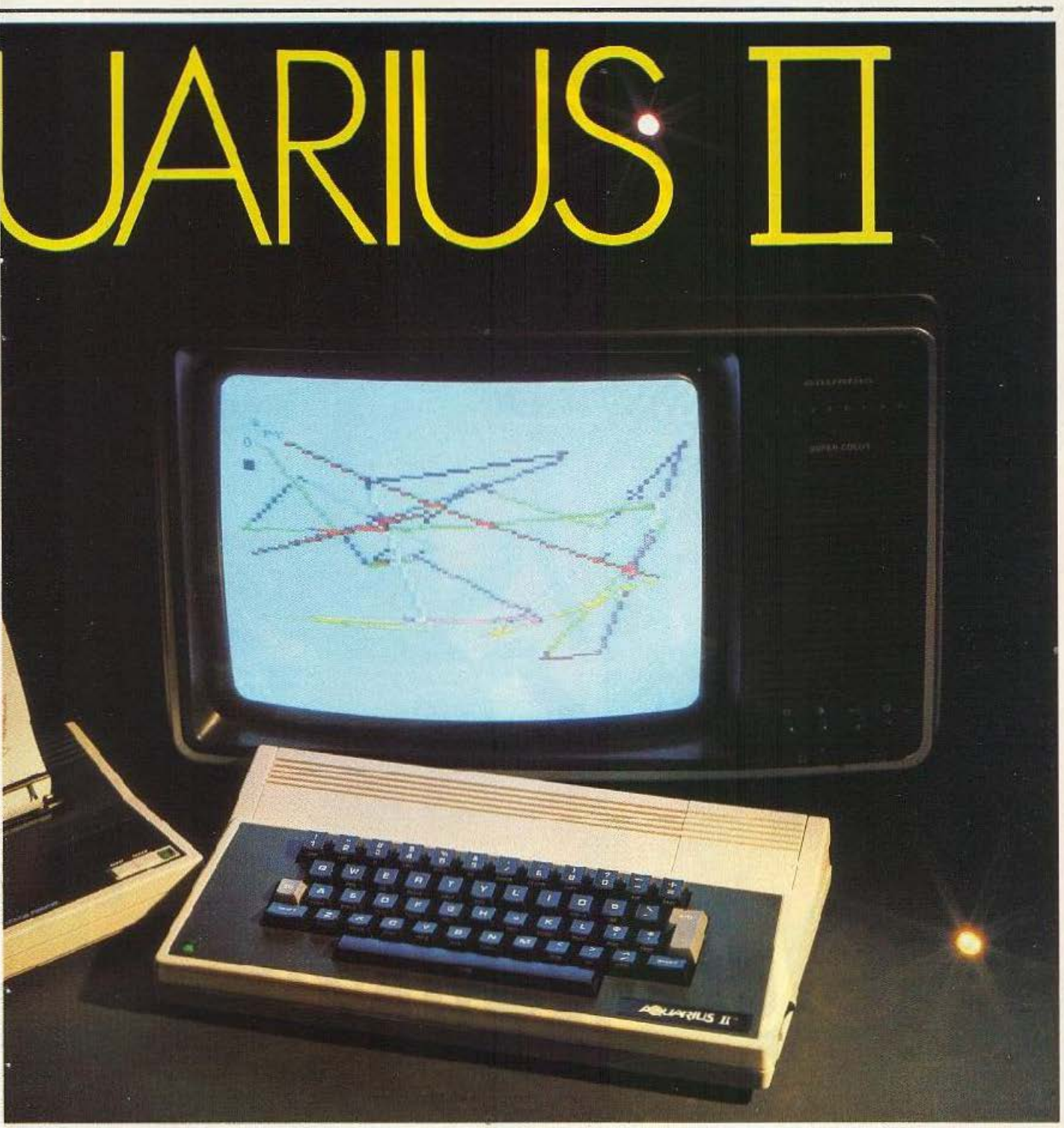


Figure 5 The Aquarius Menu command format and screen display.

```
Break in 200
Ok
LIST
10 CLS
20 FEN(10,15),2, circle","triangle","
square","box"GOTO100,200,300,400
21 STOP
200 LOCATE1,1:STOP
Ok
COPY
```

circle
triangle
square
box

UARIUS II




```
2 DIMB(1200)
3 FORA=1TO1000
4 LETB(1001-A)=A
5 NEXTA
6 GOSUB20:PRINT
7 C=0
8 FORA=1TO99
9 IFB(A)>B(A+1)THENGOSUB30
10 NEXTA
11 IFC<>0THENGOTO7
12 GOSUB20
13 STOP
20 FORA=1TO100
21 PRINTB(A);
22 NEXTA
25 RETURN
30 D=B(A)
31 B(A)=B(A+1)
32 B(A+1)=D
33 C=1
35 RETURN
```

Figure 1. Aquarius timing

As is usual in computers of this price, the Basic lacks good structure and only supports On Gosub and On Goto.

The Basic is not space-sensitive and tidies up messy input nicely and treats upper- and lower-case the same. Unfortunately, error messages are of the two-letter variety and are not always that helpful to the uninitiated.

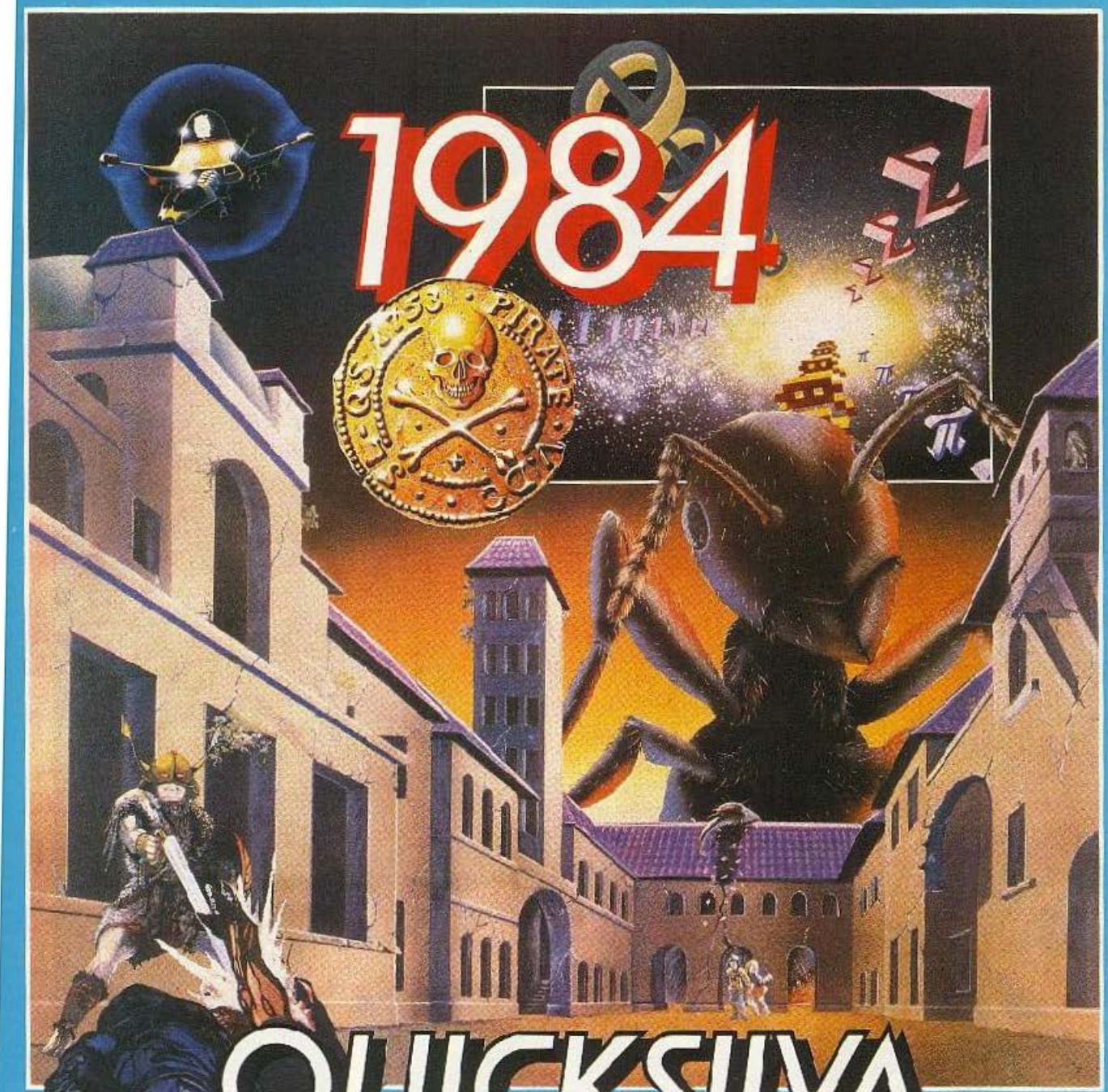
Program lines are compressed in memory. The speed test program used 227 bytes in program storage, and Spectrum used 339 for the same program, thus the small memory is worth about 2.2K in Spectrum terms. Note that as a consequence of the packaging, numerical accuracy is not so good.

The Aquarius Extended Microsoft Basic can use the Def FN command to define user-specified functions. These act as small programs within the Basic program and when given an argument will produce a numeric answer. SQR is a built-in Def and given the argument 49 would produce the answer 7.

Line and Circle commands are available which can be extended to cover colour, fill and boxing using additional parameters. Interestingly there is a subset of the MSX Draw Macro commands. Figure 2 gives a screen dump of an example from the manual showing the macro commands in use, drawing a little house.

The Aquarius II has a screen resolution of 80 by 72 using the teletext-type three-by-two graphics blocks — figure 4. The Aquarius

(continued on page 67)



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(continued from page 65)

claim of a 320 by 192 graphics resolution simply means that 320 is the number of pixels across the screen and that there are 192 down. They are not individually addressable.

The colour resolution is equivalent to 40 by 48 or 80 by 24 depending upon which way you wish to use the teletext graphics.

Two other useful commands are Get and Put. These sprite-like commands copy to and write from a specified array, producing high-speed animation — it is quicker than Peek and Poke.

Menu is a command I have not seen before. It permits a selection of items to be placed on the screen and the cursor used to make a choice from the menu — figure 5. This looked to be more than just a novelty.

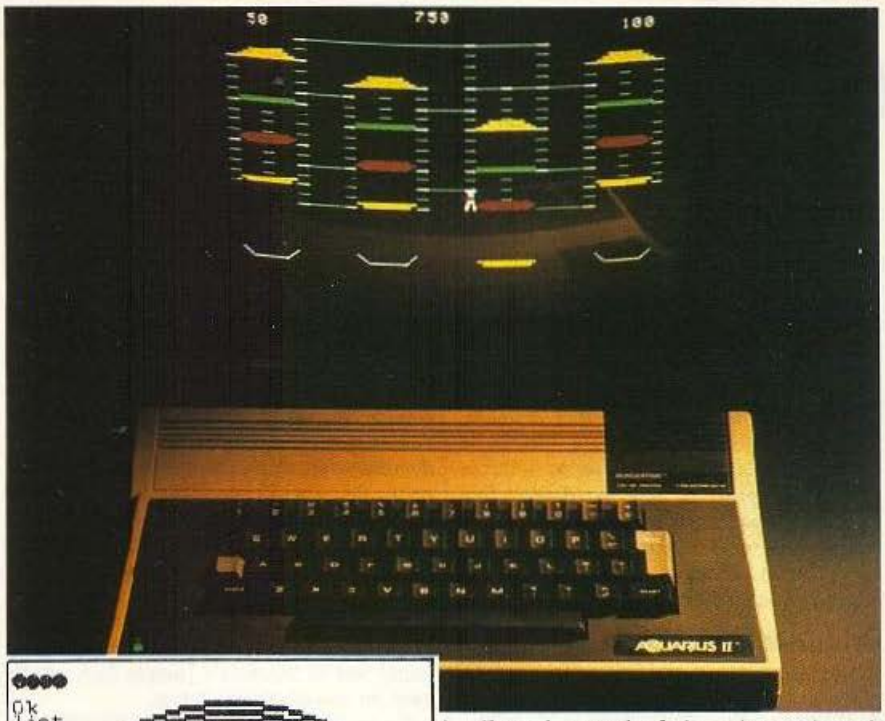
There was very little documentation regarding the sound capabilities of the Aquarius II. It appeared to be a single channel operating through the television speaker. The games cartridges supplied with the review model showed the sound to be superior to the Spectrum.

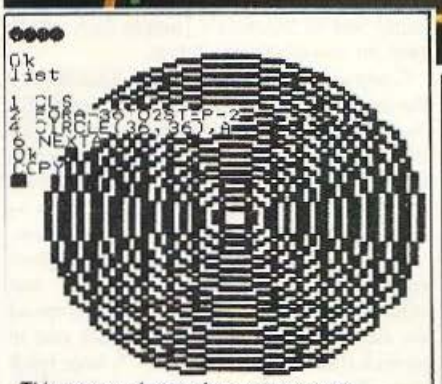
It can be seen from the screen copies that the circle command does not produce round circles. This can be corrected by using the aspect parameter of the circle command.

A new variation of the popular four-colour printer plotter is to be launched with this computer. The printer has all the normal printing and plotting facilities of the originally released Tandy model and costs £120.

- The differences are:
- There is no Centronics interface.
- The whole of the Aquarius character set is built into the printer.
- The printer can produce single colour screen dumps using the Copy command.
- The transmission rate at 1,200 baud is twice the speed of the Tandy.

I managed to hook the printer up to a Spectrum through the Interface 1 without difficulty. The graphic characters are obviously different but using the full-colour screen dump programs I have produced in the Microdrive articles, this should not be a problem.





This screen dump gives an accurate representation of the aspect ratio of circles drawn using the Circle commands.

There appears to be a bug in the Aquarius Copy command which sometimes gives an offset of half a character out of position on mixed graphics and text use.

The accuracy of the reproduction is very much better than that of the Aquarius Thermal Printer at £99.

General control of the colour printer is by:

- Text; LPrint; LList the only way to use the plotting facilities.
- Mixed; LPrint; LList graphic characters available but fewer control codes.
- Graphics; Copy for screen dumps.

The technical specification for the printer is:

RS-232C with Data and CTS
Eight bit character
One start bit
One stop bit
No parity
1,200 baud

The provisional documentation appears to be very detailed with a number of useful examples to get the user started.

Because the review model was a preproduction version of the Aquarius it did not have any documentation specific to it. Neither the computer or the printer are completely new products and therefore documentation should be good.

CONCLUSIONS

- The concept of compatibility through the Aquarius range is good and probably worth a premium. The software, comparitively speaking, is limited in both volume, quality and is also expensive, but is available. I think the peripherals could be more aggressively priced and every effort must be made to ensure users are not restricted in accessing information on the technical aspects of the Aquarius.
- At £80, a games machine well worth considering and a vast improvement over the Aquarius 1.
- It is expected that disc drives will be available in April or May but at present there is no indication of price.

CBM-64 SOFTWARE

Paul Bond flees with fleas and races in space.

WE WELCOME our new president. Our country of Ananaba should prosper under your supreme excellency's care. With such celutions of grandeur we commence this survey of some of the recent games software which has become available for the Commodore CBM-64, the computer you automatically associate with elephants.

Banana Drama proves conclusively that it ain't what you do, it's the way that you do it. Part of a batch of what might loosely be termed "simulations" from Visions Software Factory, the program puts you shaking into the shoes of Juan Rodrigues LVII. This tinpot dictator has to remain in power by skillful manipulation of public opinion and careful financial management.

Graphics are limited

Graphics are limited to colour presentations of status reports, financial analyses, and news-flashes. Your supreme excellency is sometimes, for example, asked by the industrialists to make trade union activities illegal. If you do, you will enhance your popularity with the dreaded State Security Organisation. Ananaba obviously sorted out any problems with its equivalent of GCHQ Cheltenham years ago.

Once you have decided whether or not to infringe people's democratic rights, the program presents you with a number of options. You can please foreign powers, pacify a sector, assist a sector, raise state funds, do nothing or look after number one. You can buy a private submarine, for example. You can also improve your status, but this is almost as expensive as hiring an advertising agency as some governments have been known to do.

Gusher is also from Visions. Your chance to wear a 10-gallon hat and sit in front of the computer grinning and saying "Have a nice day, y'all; getcha later". This Dallas scenario has you drilling for oil, transporting it by road, or building pipelines. You can export it by tanker or supertanker, but there is no Straits of Hormuz hazard.

A good map display shows your road tanker crawling to its destination, or your ship coming in. There are random well-based disasters, pipelines valve failures, and wage demands from ship's personnel. The aim is to be the first out of two to four players to earn one million dollars from the exporting of oil. Until then all your revenue is pounds. Maybe there's something to those New Forest oil deposits after all.

Insects are attracted to the Commodore 64 for some reason, although the only real bug I found was in Sumlock's Jumpin Jack which gave an out-of-memory error.

Creepy-crawlies abound in Quicksilva's Boogaboo — a close relative of Bugaboo for the Spectrum. That program was written by Paco and Paco and a whole host of Spanish types. Pedro Ruiz takes a bit of the credit for the 64 version, along with Felix Arrahas — music — and J L Dominguez — production.

Sting 64, another exercise in computerised entomology from Quicksilva, was less attractive. The idea is good, but the graphics are rather clumsy. Screen One puts you in joystick control of a bee-swarm — a large black blob. You use this to bounce other blob-swarms which are trying to take over your hives. Screen Two puts you in defence of an individual hive; and fly a squadron of stripey stingers into the encroaching hordes. When your bees are all dead you can swoop back to the hive and pick up another lot until the hive is taken over. The final scene leaves you defending a rather repulsive looking organism, from attacking drones.

From bees to ants. Hideous Bill and the Gigants, a gripping three-part tale of heroism and romance, is one of Virgin Games' more promising efforts. Bill — we are assured that the nickname Hideous was bestowed upon him by his father out of simple but accurate malice — must save Greta, the light of his life, from becoming ant food.

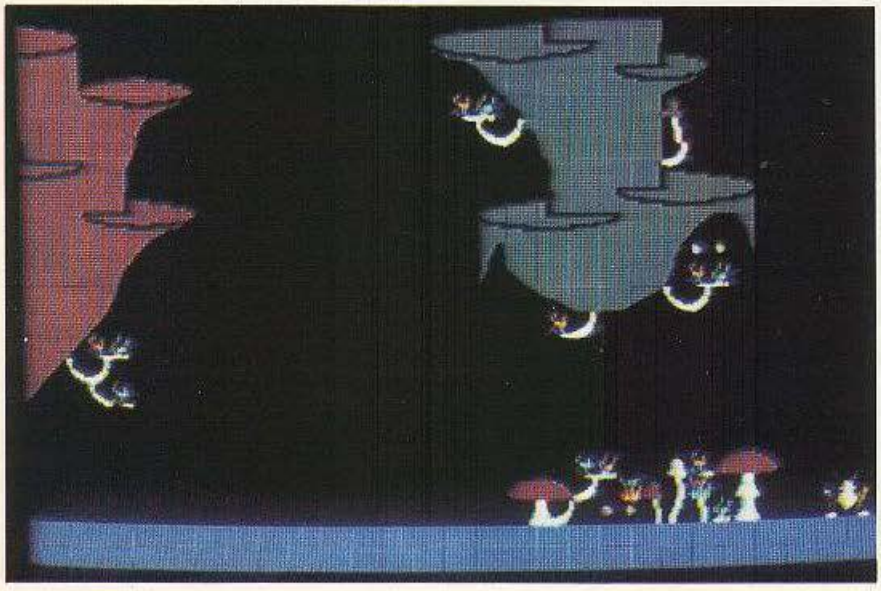
You propel Bill around a Pac-Manesque maze crushing ant-eggs, pursued by the aggrieved parents. Grab a spear and you can kill the soldier ants, but only for a set period of time. The pink ant seems particularly nasty, but *Your Computer* would not wish to be accused of singling out pink monsters for critical attention. Any reference to the peculiar aggressiveness of these creatues is based solely on detached observation. You have been warned.

You get no weapons

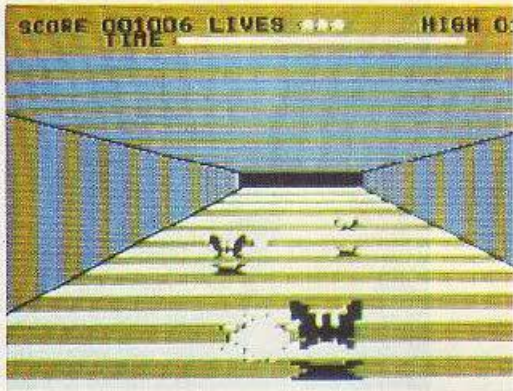
On the second screen you get no weapons; you run around the maze, squashing baby insects, presumably infants. To trap the Gigants you pick up a lever, insert it in a mechanism and use it to open and close the doors in the maze-centre. Pretty convoluted, huh? There is a tin of baked beans in the centre: you need this to get through the third level, where you tunnel down through underground workings, while the eggs are hatching, to free Greta. Then you get a surprise. This game is definitely value for money.

Spiders also get a look in, in Bubble Bus's Widow's Revenge. Arachnophobes beware. This is one of those scenarious where internecine violence in the back garden has escalated to a previously unacceptable level. Using a laser base, mobile within the bottom third of the screen, you must neutralise various ants and spiders. There is an impressive bird which whoops when you hit it and shoots up the screen. It is Centipede without the centipede. Fast and furious and quite addictive.

The depths of space are beckoning as they do about this time, but first I thought I'd have a quick game of table football before zooming off into the lonely cosmos. Of course Bubble Bus's Kick-off doesn't compare with the Chromasonics 3D football game, neither is there an option for grabbing one side of the



Left: Bugaboo from Quicksilva.
Below: Megahawk from Big C.



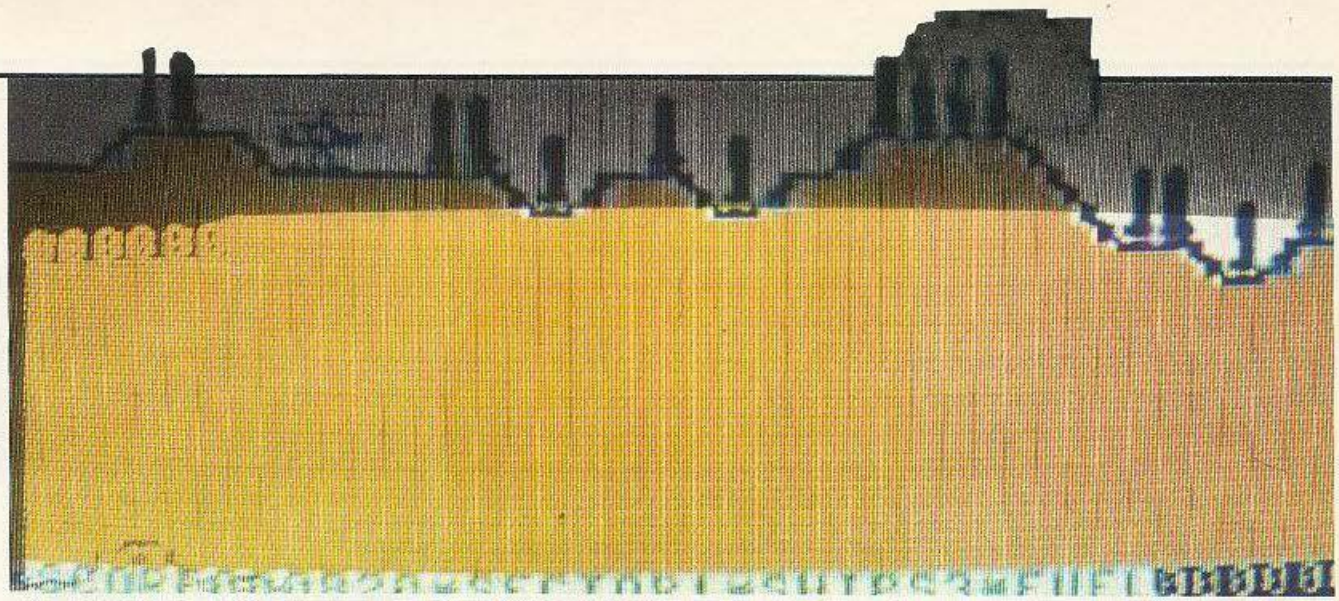


table and making sure the ball rolls down the opposite end.

Right, here we go. Zooming down the fearsome space tunnel, the first of Hagon's many sophisticated defence systems, every fibre of my being is filled with dread. The Hagon fleet has been alerted and wave after wave of astro-fighters comes hurtling at me. The fate of entire galaxy et cetera rests on the success of my mission. You know how it is. Quasar from Voyager is actually rather good; you fly down a valley with mountains on either side. Above you stars twinkle in the airless reaches of the void. The approaching craft cast shadows, giving a realistic 3D effect. Your craft can bank and swerve to avoid them. When you have knocked out these — the more skilfully you knock them out the faster you progress to the next level — you are confronted by bouncing robots. These don't cast shadows. Having dispensed with the springy cybernauts you are flying through space with asteroids, space mines and Etron rockets as they flash towards you. Next you face scene one again, but with indestructible defence poles added — you have to fly around these.

Megahawk from Big G is startlingly similar, except that the corridor sequence has a roof on it, and that both you and the approaching aliens have flapping wings. Refinements include a gauge showing how much longer you have to survive in each sector. My vote goes to the kangaroo dinosaurs that suddenly appear hopping across the planetary plain in this program.

Hopping is one way of travelling in Anirog's Moon Buggy. Piloting your balloon-wheeled personnel carrier across the stark lunar landscape, rocket motors help you spring across chasms and a ray-gun disintegrates the groke-like orange blobs sitting around with a singular disregard for the highway code. Apart from the gelatinous jay-walkers, your joy-ride is impeded by the activities of what looks suspiciously like a helicopter dropping bombs on you. Of course, everyone knows that it's impossible to have helicopters on our moon; and likewise this game is practically impossible to play. Any lunar motorist who lives longer than 25 seconds is a veteran.

Anirog Skramble pitches you into the familiar red landscape, dotted with anti-aircraft missiles and fuel dumps which you have to bomb to keep yourself flying. This is followed by a blue landscape leading into the traditional tunnel with its irritating whizzers. You can shoot these but in the next zone you are confronted by indestructible fireballs over a brown landscape: it is a competent implementation and quite good fun to play.

Above: Super Skramble from Terminal Software. Right: Skramble from Anirog.

Terminal's Super Skramble is a little more daunting. There is a distinct fuel consumption problem. You really do have to wreak havoc in every single fuel depot or you just won't stay off the ground long enough to enter the cavern.

In PSS's Neoclyps you are the good guy, freedom fighter and renowned star pilot. The bad guys, an alien race from a distant solar system have invaded Neoclyps, one of your colonial planets.

Destroy the radar towers

The aim of the game is to destroy the alien radar towers and shoot down the defence craft. You start off with 12 ships and lose one each time you crash into an aliens, a radar tower or the planet itself. Every time you down one of the bad guys, you get an energy shield which means you can move through solid objects — you can dive down through the city structures and into the planet's surface itself.

Stellar Dodger from Terminal Software plunges us into another other-wordly scenario unlikely to encourage tourism. As an interstellar shuttle pilot you provide the vital link between your starcruiser mothership and the planetary supply dumps. In the way is a treacherous asteroid belt. The screen display shows the carrier, from which you detach your spherical lander. It even has little flashing lights around its equator — by pressing the fire button on the joystick. Dodge the rocks and land on one of the three blastpads at the bottom of the screen.

The game can be played with the keyboard as well as with joystick, but I don't feel myself quite in accord with the effusive blurb on the packaging. Superb hi-res flicker-free sprite graphics? Superb, they ain't. Just plain ordinary. Full colour? Maybe, but the things on the screen are so small they look mostly white. Great sound effects? I should jolly well hope so.

Company	Game	Price
Visions Software Factory 1 Felgate Mews Studland St London W6 9JT	Gusher Banana Drama	£9.95 £9.95
Quicksilva Palmerston Park House 13 Palmerston Rd Southampton SO1 1LL	Sting 64 Booga-boo	£7.95 £7.95
Virgin Games 61-63 Portobello Rd London W11 3DD	Hideous Bill and the Gi-gants	£7.95
Bubble Bus 87 High St Tonbridge Kent TN9 1RX	Kick-off Widow's Revenge	£5.99 £5.99
Anirog Software 8 High St Horley Surrey	Moon Buggy Skramble	£7.95
Terminal Software 26 Church Lane, Prestwich, Manchester.	Super Skramble Stellar Doger	£7.75 £7.75
PSS 452 Stoney Stanton Road Coventry	Neoclyps Cosmic Split	£7.95 £7.95
Big G Birchmoss Hall Haverton Nantwich Cheshire	Megahawk	£6.95
Voyager The Business Centre Claughton Road Birkenhead L41 6ES	Quasar	£5.99

DRAGON SURVEY SOFTWARE

From a quiet day fishing on the riverbank to zooming through hostile space zones, Paul Bond discovers the Dragon has it all.

IF THERE IS one thing the Dragon has been blessed with in abundance by the software companies, it is adventure games. Another popular theme, for some reason, appears to be Kong-style games. So if you are into swords and sorcery, dungeons and dragons, and a certain amount of running up and down ladders evading the wrath of apes/droids/icky things, then the Dragon has it all.

Monsters from Softek Software is a prime example of the latter genre. Your spacecraft lands on the surface of Zol II, which as luck would have it is a veritable Swiss cheese of ladders and platforms patrolled by bellicose monster-robots. You have to find a power module in each mine and return it to your ship before your air supply runs out and you succumb to anoxia.

On-screen this gripping scenario is reduced to the usual grid of vertical ladders and horizontal platforms depicted from a side-view in the traditional autumnal Dragon colours of green, brown and yellow. The ladders are always yellow. It is tempting to conclude that the Dragon's home environment of bosky hillsides, verdant valleys and fertile sylvan glades has exercised some strange atavistic influence on the Welsh micro's colour set. The result may be restful, but when looking at a batch of Dragon software one is left with a craving for a splash of colour, perhaps the torrid crimson of the heraldic dragon of Cymru itself.

If you succeed in your task by dexterous use of the cursor keys to move the Shift keys to dig, you can penetrate further into the alien delvings and encounter monster-robots who have actually found out how to climb ladders and give you quite a hard time. The computer games fall into certain generic types is undeniable. This is a competent implementation of the digging-holes-for-monsters-to-fall-through type.

Bonka is another variation on the same theme. This scenario from J Morrison Micros thrusts a man wearing a bowler hat and carrying a space-hammer in among a bunch of homicidal, highly-charged Blue Meanies. This is closer to the arcade ancestor, except that the Meanies do not wave their antennae about, but the idea is to lure them into holes dug with the trusty space hammer and bonk them on the head.

The worst example

There are four different ladder layouts, four selectable speeds and option of one to nine Meanies to start with. More points are added for the more levels the Meanie falls — the idea is try and dig holes from the top level down to the bottom. Of course your oxygen supply is running out. This would get my vote, if only for the fact that the Meanies are blue. The ladders remain stolidly yellow.

Fireball, from Abacus Software, is the worst example of the Kong tendency. You cannot even get the man up the ladders. The company, who should not be confused with Abacus Programs, are hard to contact, so I could not deduce if this bug was solely due to incomplete documentation. Why it is called Fireball is a complete mystery. You are on the bottom level being assailed by half-sentient purple jellies. Apparently if you hit the fire-button this will help you in and out of lifts. Sadly there are no lifts in this particular program.

There are, of course, shoot-'em-ups for the Dragon, but most of the ones tested for this review remained relatively restful. Microdeal's Skramble sticks close to the standard Scramble format, although you probably would never have guessed this from the ingeniously original name. You zoom over mountains, bombing fuel dumps, braving anti-aircraft fire and shooting down missiles.

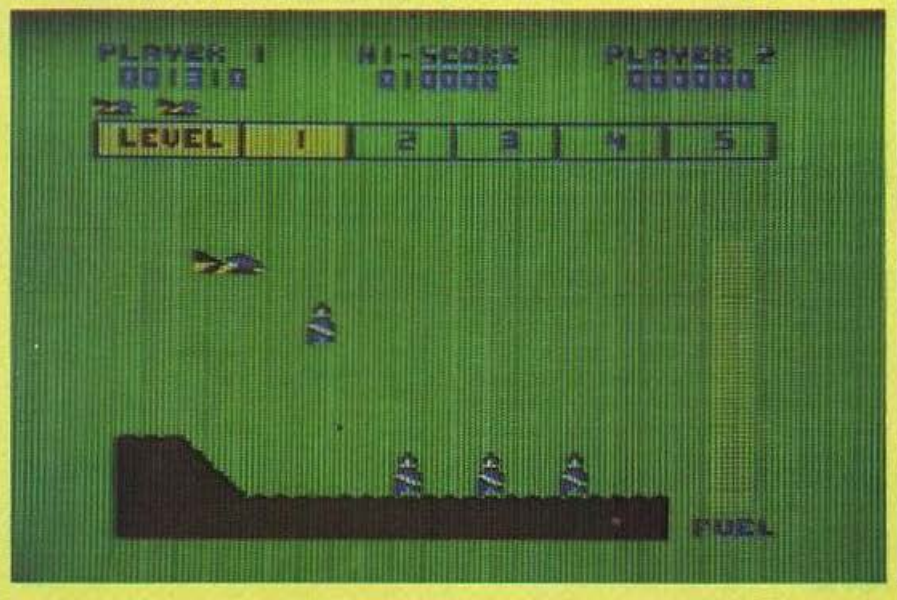
Dragonhawk from Microdeal presents us with an unedifying scenario of larvae and flies littering the screen. You have to shoot all the flies but avoid hitting the larvae because they turn into birds. The Nuffield biology course really has a lot of things to answer for.

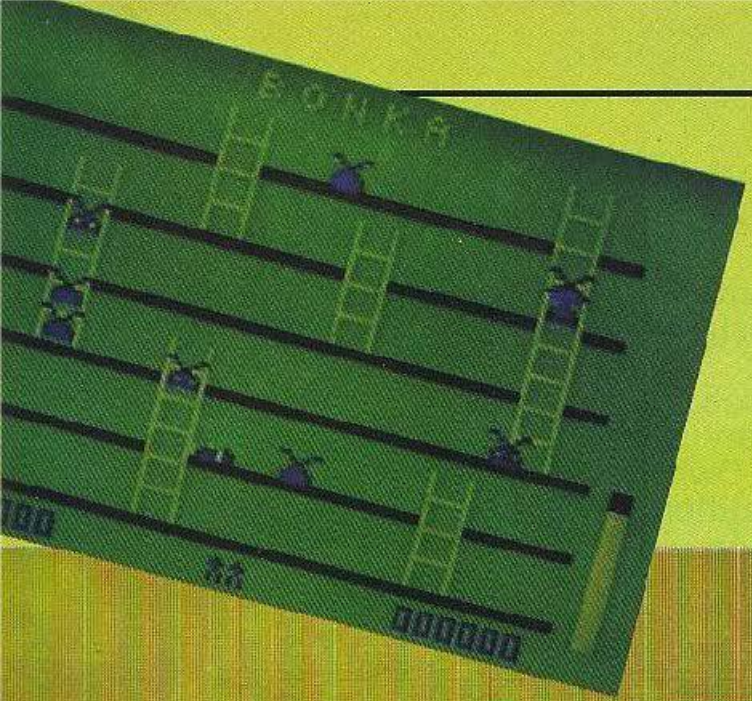
The problem with the birds is that they hamper your movement somewhat by blowing up every time you bump into them, and they tend to spend a lot of time lying around on the ground. You are supposed to be saving the unfortunate Fred from being collared by a Dragonhawk which flaps ponderously across the top of the screen, hiding behind a brown shield. You can shoot the bird, provided you do not trip over one of the fissile avians dust-bathing to the base of the screen, but you really only get two opportunities to do it. If you shoot it after Fred has been seized in its claws then you have to catch him in a tray, of course. The whole thing has the perverse logic of dream except of course that dreams usually have a higher resolution and are much more colourful.

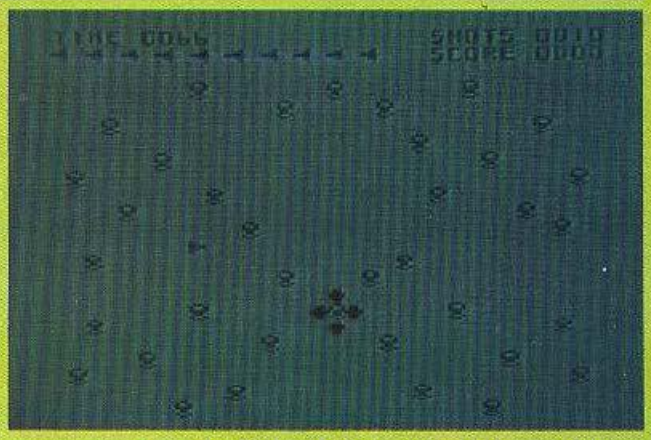
Being the adventurer you are and having survived all the previous adventures you have attempted, you still went out and bought Microdeal's Ultimate Adventure 4. This is, we are assured, an adventure game with a difference. You are obviously over qualified for any more expeditions of the dungeons, haunted houses, space trek type. So here we have a game which is totally new, that is, it has all the elements just mentioned thrown in together.

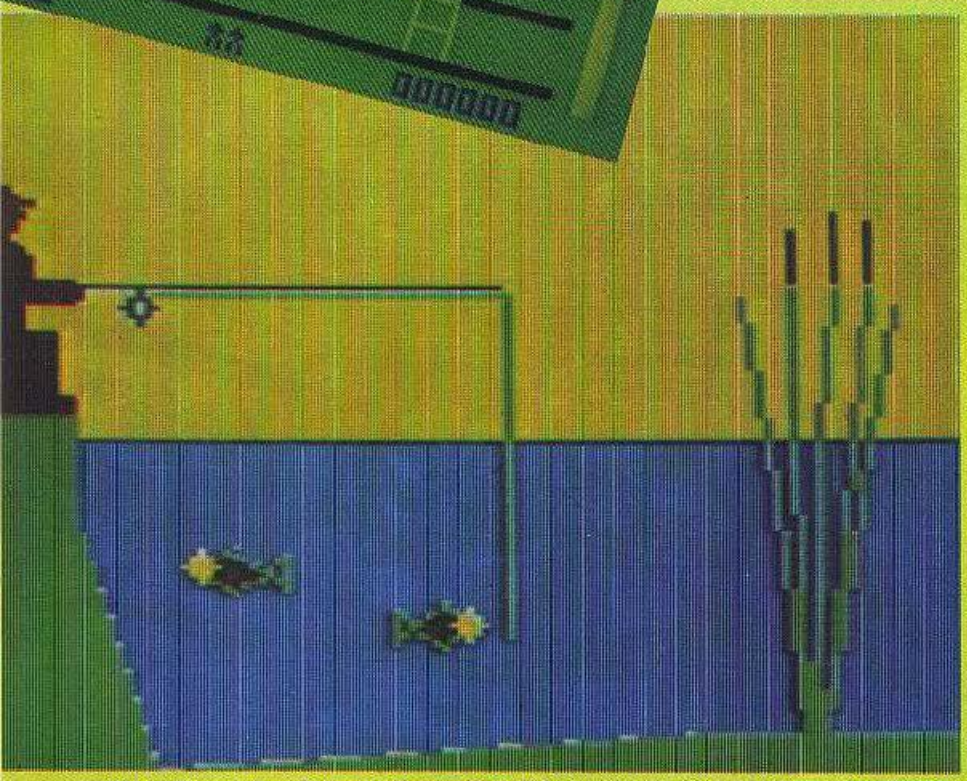
You begin with £250 in the market place. You have to buy gear ranging from spacesuits to shovels to assist you in your quest. Your goal is to accumulate £1,000. Common problems are encountered: each move diminishes your initial 250 strength units. Most is lost in encounters. Your survival depends on using the right item for the right fight, but you can only carry up to eight objects, including treasure. There are seven treasures to be collect.

Below: Skramble from Microdeal.









Above left: Bonka from J. Morrison Micros. Above: Avenger from Voyager Software. Left: Hooked from Shards.

The difference here is the portholes which link the various parts of the adventure together. You can be wandering down a dune and suddenly get zapped into a jungle, or somewhere even more outlandish.

A fishing rod might have been of some use to me in my travels — however I had plenty of opportunity to build up that resource which the "compleat" angler requires more than any other. Patience. The screen display for Shards' Hooked depicts a brother of the angler sitting hunched on the riverbank clutching a telescopic rod guaranteed to make Izaak Walton green with envy. As no man is born an artist, so no man is born an angler, as the great fisherman used to say; this simulation did nothing to convert me, but I would hazard that it replicates faithfully the boredom of the actual pastime with none of the disadvantages of contracting arthritis or killing swans by poisoning them with lead weights.

This is the sort of game that might come in useful for people recuperating from the effects of prolonged space combat such as we experience in Avenger, by Voyager Software. This has a rather peculiar loading protocol, not well explained in the documentation — I had to mess about a bit to get the machine code in. Screen 1 presents you with a number of green objects — munitions stores — which you have to land on without bumping into the orange cross-shaped mines.

Each landing gains you 10 shots in the second stage of the game where you are catapulted headlong into an advancing swarm of actually rather inoffensive aliens. They do not shoot at you. You, however can butcher them mercilessly — if it moves blast it as they say on the more bloodcrazed blurbs. Each hit scores five points. If you get as far as the third screen, you have to try and attain the top of it in the time allowed.

You have a fly through a couple of asteroid belts however and if you hang around too long waiting for a gap a missile will be launched these missiles never miss. Each level has its own high score table.

Illusions of speed

Devil Assault, another Microdeal game, this time by well-known software cowboy Tom Mix, shows the kind of illusion of speed that can be generated on the D32. As in the previous game you can select the colour of the background you wish to play on. There are six skill levels. These determine the starting level and the type of missile fired.

At the beginning of each screen the alien antagonists materialise by having their component parts appear to rush together from each side of the screen, accompanied by an impressive whooshing sound.

Vampire bats fly back and forth across the first screen, while the lowest one tracks you and tries to bomb you *a la* Galaxians. Should you manage to hit one of these creatures they split in two — if it is one of the lowermost pair the rest of the flock come swooping down at your laser base. At higher levels, the devil himself appears running across the top of the screen and dropping a flaming cauldron which severely hampers your movement. And this is not all — presently you have to put up with crazed robots on the second screen, and last but definitely not least, the belligerent sproings — purple blobs which bounce about trying to stomp on your base.

Company	Program	Price			
Softek 12/13 Henrietta Street, London WC2 8LH	Monsters	£6.95	J Morrison Micros 2 Glensdale St Leeds LS9 9JJ.	Bonka	£7.95
Voyager Software Business Centre Claughton Road Birkenhead, Merseyside L41 6ES	Avenger	£5.99	Microdeal 41 Truro Rd St Austell Cornwall PL25 5JE	Skramble Ultimate Advanture 4 Dragonhawk	£8.00

DESIGN YOUR OWN MICRO

Everyone wants to be a computer designer now, as the flood of entries for our January Design Your Own Micro competition shows. Meirion Jones reports on the ideas that appealed to our independent team of experts. Next month — what the computer companies think.

WAKE UP Clive Sinclair and Commodore and Acorn too. So far Aphrodite, Da Vinci, Invincible, Mandarin and the rest have just been project code names in the *Your Computer* vaults. Now we can reveal the plans our readers have for putting better micros at their fingertips — and there are more would-be computer designers out there than you ever imagined.

Ideas ranged from a go-anywhere portable with a built-in radio telephone to a latter-day Nascom hobby computer. Entries came in from all over the world including an IBM lookalike from Angola and a Bang & Olufsen hi-fi style design from Denmark.

Some readers put in more work than others. While half a dozen people sent in sketches on the backs of envelopes other covered pages of graph paper with circuit diagrams and Peter Au-Yeung sent in an 8,000 word typed submission outlining his ideas.

The overwhelming majority of the entrants took the competition very seriously — except, that is for Matthew May of Dublin. His Perfect Micro would have a robot arm for typing in programs, not to mention robotic legs, an acoustic Modem to give you access to "everything from Ceefax to Nato" and a list of languages including Basic, Pascal, Fortran, Rude, Assembler, French, Logo, Pogo, Pretty Basic, Very Basic, Forth, Second, Noddy, and Big Ears.

A surprising number of the entries in all categories were improvements on the Spectrum. The most popular idea was to give it a proper typewriter keyboard, with function keys better sound, cartridge and joystick interfaces and a built-in cassette recorder to tidy up loading. You could tell that the dreaded ZX-81 RAMpack wobble problem had burnt its way indelibly into some of the designers' minds. They had drawn agricultural-looking bolt on peripherals which would not have come adrift in a nuclear war let alone if someone jogged the table when you were programming.

Sinclair's QL was announced before the competition closed — in time to affect some of the later entries. One design was just a rough sketch of a QL in the attache case, sawn off at the end of the keyboard so that the twin Microdrives could be fitted in by being turned through 90° and fitted above the keyboard next to a flat screen TV.

Like Apple's Macintosh, also announced in January, the QL has one of the 68000 family of processors at its core so it was no surprise that the last few mailbags of designs were full of 68000-based machines. Overall most readers went for the 8-bit central processors they know and love — 6502s if they were Commodore, Oric or Acorn users, Z-80s if they had a Sinclair and 6809s if they had a Dragon or Tandy.

The supposed benefits of compatibility with the IBM PC drove some to adopt 8035s and 8086s and there was a sprinkling of Z-8000s and an 80186s.

Top, everything you wanted on a micro except a spacebar. TV, phone, video recorder and computer in one portable unit. Aphrodite, above, and Da Vinci, right use more conventional technology.

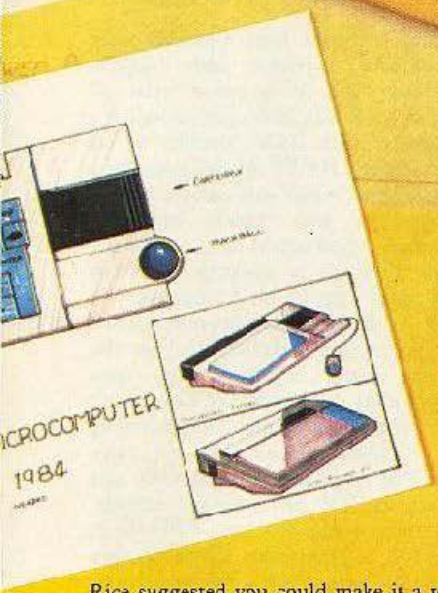
Built-in light pens and joysticks seem popular although most designs included a provision for the joystick to be detached from the keyboard when necessary. Alexander Martin, whose sketch carried the doleful note "Product design graduate — job needed" included a detachable trackball in his plan.

While most of the light pens where intended for drawing on screen or selecting from a menu Matthew May's consisted of a light bulb on the end of a wire "for programming in the dark". Richard Heimans gave the credit to his mum for suggesting a remote control joystick and several designs used infra red or ultrasonic beams to communicate between peripherals.

Most of the battery-powered micros suggested included some sort of flat screen display on the keyboard even if it was only a single-line liquid crystal display. One cheap and easily practicable idea which occurred to both John Niven and Patrick Lawton was a little watch-style LCD showing how much free memory is left in the computer at any time.

By incorporating a battery — as Andrew

Peter Au-Yeung's 8,000 word submission, below, soon became know as "The Book".



Rice suggested you could make it a real time clock too. This could be used to datestamp files as you created them. A warning panel flashing up messages such as OH — overheating — was yet another proposed use for an LCD.

Most of the competitors wanted between 16 and 128K of RAM in their micros with easy interfacing to floppy or even hard disc units for extra storage. Silicon discs were one of the more original ideas for additional storage. These would look just like games cartridges but would contain a small battery and up to 256K of RAM on CMos chips which need little powers to keep the memory refreshed.

When you plug one of these into your micro it will behave like a disc drive except with instant access. You can unplug it safely without losing the information on it.

The competition was split into three categories and although there was an overwhelming response in the Junior and Open sections we had relatively few group entries. Many of the group entries were meant to be IBM compatible.

The best of these were the Phoenix — a £230 128K micro designed by Hove Park School Computer Club and the Adept 42 BC, sent in by David Moore from Dorset, which has a built-in disc drive. The 42 BC has a number cruncher unit in addition to the 8088 to speed up calculations — this is a primitive form of multi-tasking — leave out the word primitive as David Moore suggests and you have "an ideal selling point to the gullible".

In top mode the 42 has 924 × 240 resolution taking up a massive 57K of screen memory. The £450 price tag suggested for the Adept sounds a little optimistic for a 128K machine with a built-in 5.25in. disc drive.

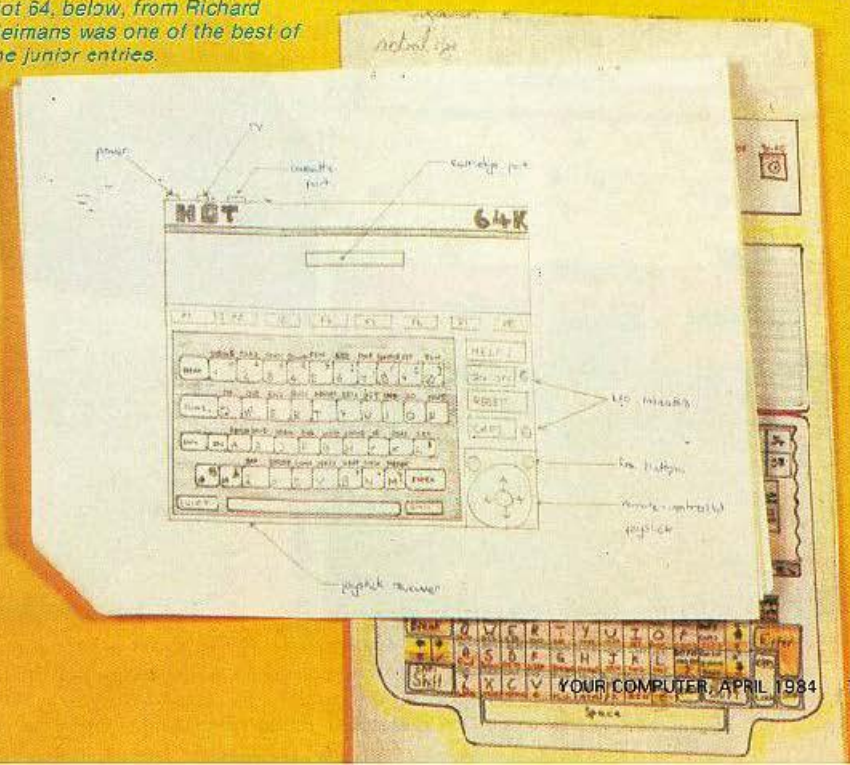
The Phoenix attempts to squeeze extended Microsoft Basic, Logo and an operating system into 16K of ROM. It also has a sound range of 12 octaves — well beyond what humans can hear — presumably in case there are any dogs or mating prawns in the audience. Automatic Load and Save buttons make the Phoenix user's life easier.

6502s were also popular with the group entries. Silicon City Micro was a £150 Commodore 64 look-a-like with a built in detachable joystick. The cheaper 16K Prism concentrated on making interfacing easy with a MIA chip — miniature interface adaptor.

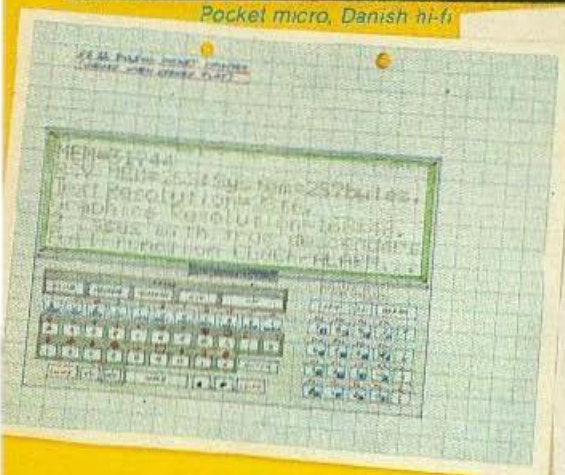
At Junior level the under 14s were not afraid to send in circuit diagrams. Barry Adams did with his anonymous 64K Z-80 micro. For £170 it looked good value and well thought out but 28 graphics modes would frighten all but the most daring new users. 10 year old Michael Davis's Zodiac, on the other hand was a simple but effective idea for a BBC

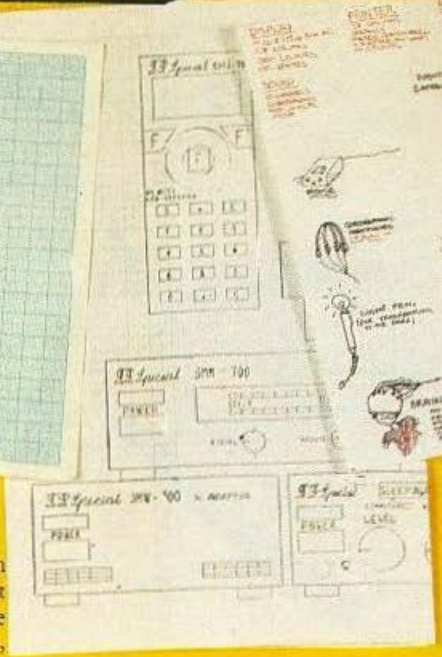
(continued on next page)

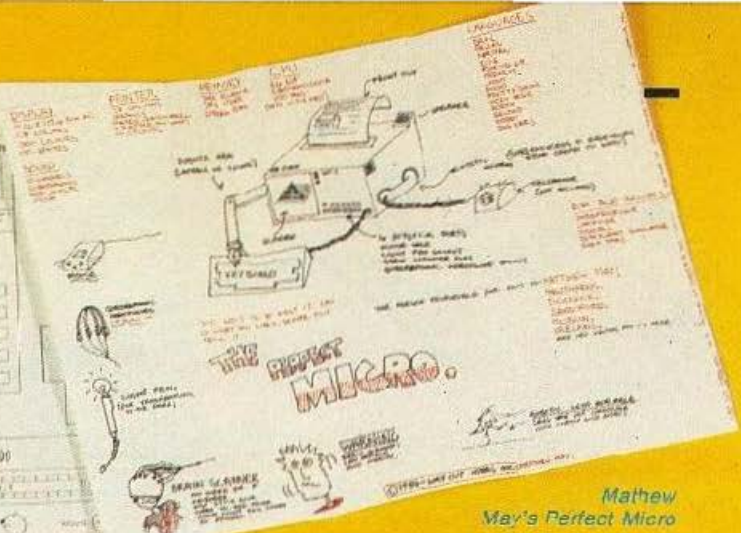
Hot 64, below, from Richard Heimans was one of the best of the junior entries.



Pocket micro, Danish hi-fi







Mathew
May's Perfect Micro

(continued from previous page)
compatible 32K computer with a built-in cassette drive. If only Acorn had had a look at Michael's design the Electron might be blessed with cartridge and printer ports, though the flat screen he suggests would have made the Electron even later.

John Niven from Cman, who thought up the LCD RAM counter, proposed a 48K micro with the odd mixture of Z-80 and 6809 processors and BBC-style Basic. Nicholas Speed wanted to supply four language cartridges with his 64K Ideal M84 — Basic, Logo, Pascal and Forth.

Heimans Operational Technology, alias Richard Heimans from Camberley, had a real keyboard, improved sound 64K RAM and 6502 chip four about £120. A built-in compiler was one of Richard's priorities.

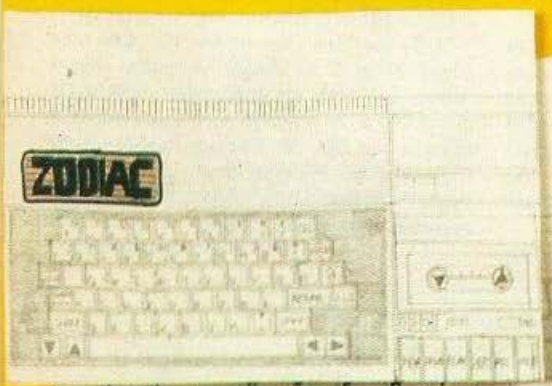
In the Open the competition was toughest of all. Peter Au-Yeung's submission — which because of its weight soon became known as "The Book" was very carefully thought out, with a Z-80 and an 8085 but with only 80K RAM and no built-in storage for around £500-£600 it would have a limited market. David Kinrade's pocket micro — half the size of a paper back book — was immediately appealing. When you open it up there is a six-line LCD in the lid. The proposed 6502-compatible CMos CPU is coupled with 64K RAM.

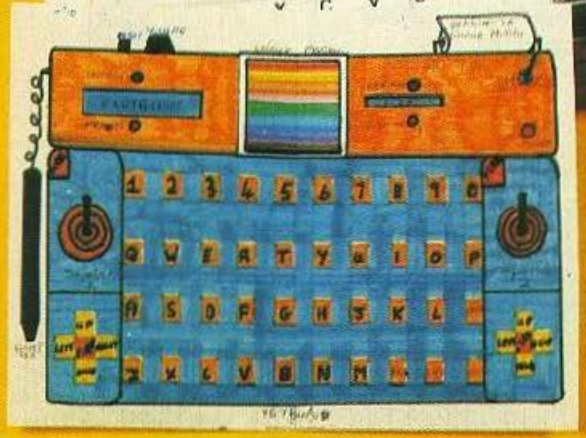
The small size does not stop David Kinrade from building in two joystick ports and facilities for expansion. A little add on unit would make 128K silicon discs for mass storage.

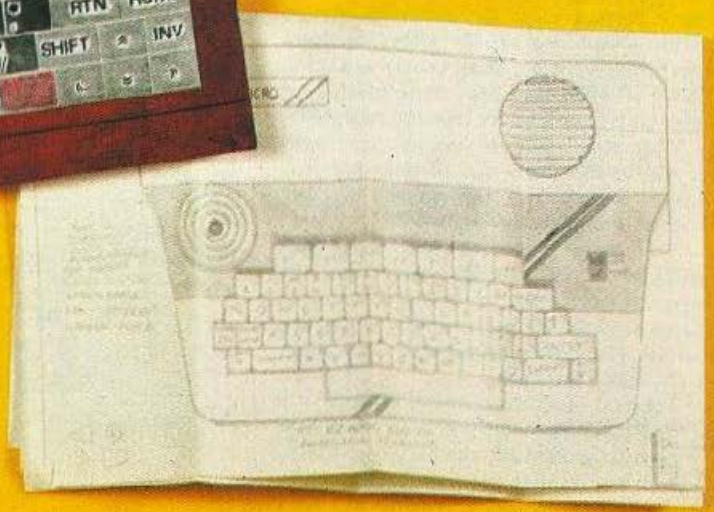
Flemming Pedersen from Denmark went for a modular approach with Modem, printer/plotter and even power unit all designed to stack with hi-fi units including a stereo cassette deck which doubles up as computer storage. His FP Special would be a 64K 68000-based micro with remote control of peripherals and remote joysticks. Maximum resolution would be 640×512 and Flemming Pedersen is working on a new language called Plim for his FP Special.

Duncan Kinnaird's Aphrodite concentrated again on peripherals — including a laser disc player and piano keyboard. The most imaginative entry came from TM Colver with his go-anywhere portable micro incorporating a radio telephone, colour TV and video recorder. Two cassette units taking video tape would act as TV or computer storage. Colver's micro would have twin CPUs — Z-80 and 6502 — presumably CMos versions unless you planned to take a yak loaded with car batteries on your travels. The radio telephone might have to wait for cellular radio before you could make the most of it and it might take a couple of years before flat screen colour TVs become cheap and reliable.

So much for *Your Computer's* view of your entries. Now we are taking the leading designs in each category to the computer companies for their opinions. Watch this space. ■







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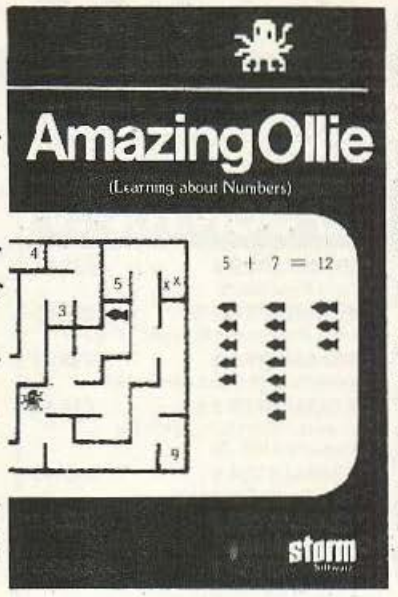

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GAMES WRITING PACKS

Producing fast-action games without the need to learn machine-code programming — Simon Beesley reviews a crop of games designers including the newly-released Hurg.

THERE ARE FEW more dismal experiences than playing a version of Space Invaders written in Basic. The invading aliens dawdle across the screen while your missiles take an age to reach them. The fact is that Basic is usually too slow for writing adequate arcade games. For best effects you need the speed and flexibility of machine code. But for most of us learning machine code is a daunting task.

As an alternative there are now a number of programs which offer a more painless way of writing arcade quality games. These are either extensions to Basic or full-blown games designers.

Melbourne Houses's Hurg is such a program. Hurg, incidentally, stands for High-Level, User-Friendly, Real Time, Games Designer. The terms High-Level and User-Friendly refer to the fact that by using Hurg you can design a game without writing a line of code — the entire system is menu driven. It offers, in fact, an extensive hierarchy of menus and sub-menus which between them cater for almost every aspect of designing a game.

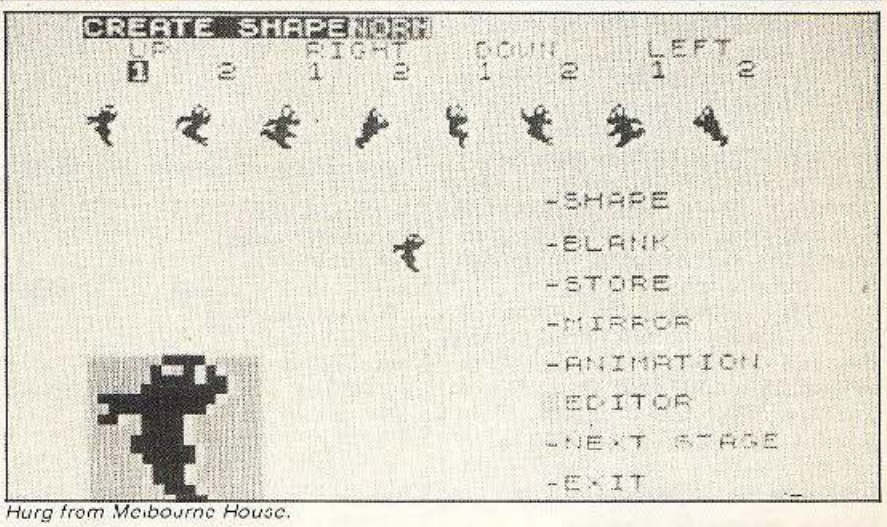
Define eight objects

Not only, for example, can you define up to eight different objects but you can also animate each in a different way and determine how it is to move. Movement can be described in considerable detail. You could instruct an object to mimic the movement of another object or give a weighting to movement in certain directions. Alternatively you could define eight paths and link four of them together.

The animation facility is extremely impressive. Each object can be given up to eight animation sequences. It can either be allotted two different shapes for each direction or be made to pass through an entire eight shape cycle in every direction. Once you have defined its shapes you can set the speed at which animation occurs as well as the speed with which the object moves across the screen. The Shape Generator is one of the most enjoyable features of Hurg. In effect it lets you construct the frames for a cartoon. As soon as you have defined at least two different shapes you can see your cartoon character in motion.

There are a host of other options such as a regeneration menu, a collision table, and a games variation menu. To take just one of these, the games variation menu allows you to alter the pattern of a game after a specified event. Thus you could instruct the ghosts in a Pacman-type game to move away from the player when a power pill has been eaten.

Although there is no facility for designing a background you can load in a predefined screen. This means that an assortment of different games can be designed. Two of the demonstration games included with Hurg show its range. Manic Koala is a creditable Manic Miner type game — with only one screen — while Ms Hortense is a Pac-Man variation.



Hurg from Melbourne House.

Designing a complete game with Hurg is quite a complicated business. The program's facilities are so extensive that they need much fuller explanations than are given in the manual. More examples are needed. The manual gives an example of how to write a simple game but this is rather sketchy. When I came to design an Invaders type game I was unable to make my missile leave its silo. Doubtless I had made an elementary mistake but detailed step by step instructions would have been handy.

Quicksilva's Games Designer is easier to use but more limited in its scope. Essentially it is an instant shoot em up kit. Seven game formats are open to you — Invaders, Asteroids, Scramble and so on — but these are really a matter of fixing the directions the aliens come from and how your character moves. The program does not allow you to design a game at the same level of detail as Hurg. So you are confined to producing variations on the same shoot-em-up theme: aliens approach and you blast them out of the skies.

Again, it is menu driven. There are eight options on the main menu: Play Game, Select New Game, Alter Sprites, Configuration, Movement, Attack Waves, Load from Tape, and Save to Tape. Selecting any one takes you to another section. The sprite option, for example, takes you to a character definer where you can define either your own player and missiles or the enemy characters and their missiles.

Included in the configuration sub-menu is quite a sophisticated sound editor — a feature lacking in Hurg. By moving a slide up and down on five scales you can create the sound of your choice for explosions or missiles. Given the range of different sounds that can be produced this is particularly simple to use as well as being fun to play with.

Although you can give the aliens a limited degree of animation and set their flight path you cannot animate your own character. This feature does not begin to compare with Hurg's extensive facilities for defining animation and movement. Only one set of aliens can appear on the screen at any one time and all move in the same way.

Nor is it possible to define the background. The background option reduces to a choice of colours and the decision to include stars or not.

But for all its limitations Games Designer is

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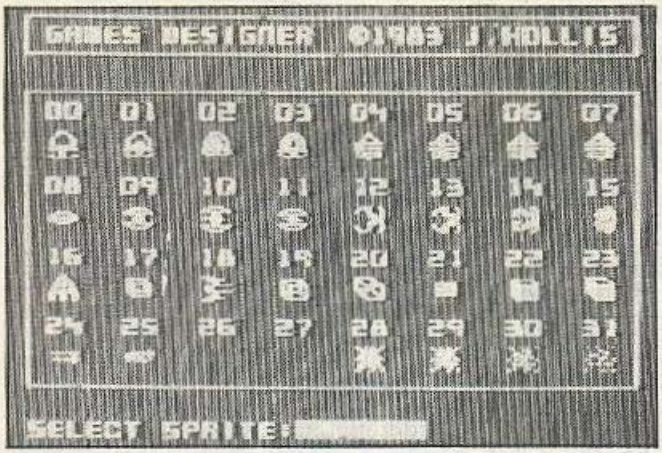

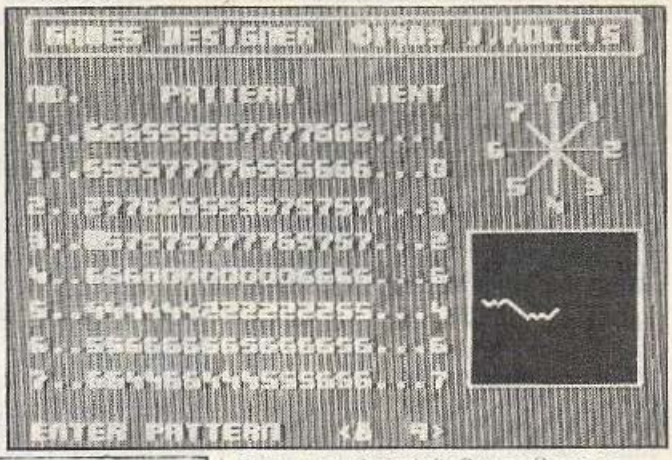

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a highly effective package. The eight pre-defined games which are included with it show that you can certainly design games of commerical quality. If shoot-em-ups are your taste then this progam will allow you to indulge yourself to the full.

Games designer programs, however, have their frustrations. They restrict you to a set course menu. With Hurg, for example, it is possible to design a Pac-Man game but you could not instruct the ghosts to move intelligently. As the blurb for Interactive Software's Scope puts it, such programs cannot satisfy those who enjoy 'the challenge of free programming'.

Scope is a computer graphics language. It has 31 command words which are tagged onto Basic Rem statements. They cannot, however, be intermingled with Basic. Once you have written a Scope routine it needs to be compiled into object code in another area of memory. The idea is that once compiled your graphics routine can be called from Basic.

Entire game in Scope

You could also write an entire game in Scope; although with only 31 commands on hand this would be a daunting task. Scope does not allow floating point variables so the sine and cosine functions cannot be used. Nor are there commands for multiplication and division. User-defined characters need to be set up in Basic.

At first glance Scope's syntax seems rather complex. To set up the equivalent of the empty loop

```
FOR A = 0 TO 100 NEXT
```

requires the following commands:

```
10 REM Var,a,0
20 REM Label,A:
30 REM Inc,a 1:
40 REM Test,194,a,100,A:
```

But the language's graphic commands like Plot,Draw and Attr are familiar enough; while Fscr is a useful addition which scrolls the screen one pixel in any direction.

By using Scope to build up graphics routines you could undoubtedly speed up your Basic programs considerably. It is also an interesting introduction to lower-level languages — a compromise between Basic and assembly language. As an alternative to Scope one could use a fully fledged Basic compiler or Forth.

Richard Taylor's Fifth is a more accessible aid to writing fast games and, arguably, just as effective. One of *Your Computer's* regular contributors Richard Taylor needs, as they say, no introduction. In an interview he once said that he likes to make machines do things they are not designed to do. Having given the ZX-81 high resolution and speeded up its loading rate, he is now doing amazing things for the Spectrum. Fifth is a 4K extension to Basic which lets you harness effects normally only available through machine code. It supplies 25 new commands and a further 13 functions. To use them you simply enter the commands and their parameters after Rem statements.

The largest group of commands provide the Spectrum with a sprite facility. The beauty of this is that since the sprites are interrupt driven they move independantly of your program. You can specify the direction of one of up to 255 sprites and then set the speed and number of pixels they jump at a time. Once set in motion the sprites carry on moving while the program attends to something else. If a sprite collides with another object or veers off the screen control returns to Basic whereupon you can redirect it.

Along with the sprite facility Fifth offers a number of other new commands. Among them are Sound, a far more powerful instruction than Beep, and Replace which changes colours on screen in a similar way to the BBC's VDU 19 command. With Get and Put you can store away any rectangular section of the screen and then reprint it at a new position.

Company	Game	Price
Melbourne House, 131 Trafalgar Road, London SE10 *48K Spectrum*	Hurg	£14.94
Quicksilva 55 Havilland Road, Ferndown Industrial Estate Wimborne, Dorset. *48K Spectrum*	Games Designer	£14.94
ISP Marketing Ltd Crown House, 38B High Street, Godalming, Surrey *48K Spectrum*	Scope	£11.95
CRL 140 Whitecapel Road, London E1 1EJ *48K Spectrum*	Fifth	£9.95
Commodore Business UK Ltd 675 Ajax Avenue, Trading Estate, Slough *Commodore 64*	Simons' Basic	£50

Above and above left: Games Designer from Quicksilva

Put together these facilities make up a highly useful tool for writing quality games without dipping into machine code. The sprites are particularly impressive. As they can be set to move pixel by pixel at a rate of 50 jumps per second they are both fast and smooth.

The Commodore 64 already has sprites but using them in Basic is a slow and tedious business. Almost unchanged since the days of the PET Commodore's Basic now looks a little long in the tooth. It has no specific commands to handle sprites, high resolution graphics or the 64's sophisticated sound chip. To access these facilities you must instead rummage through the manual in search of the requisite Pokes.

Simons' Basic remedies this state of affairs. It is an extension to Basic which makes good the resident Basic's shortcomings with a further 114 commands.

Number of novelties

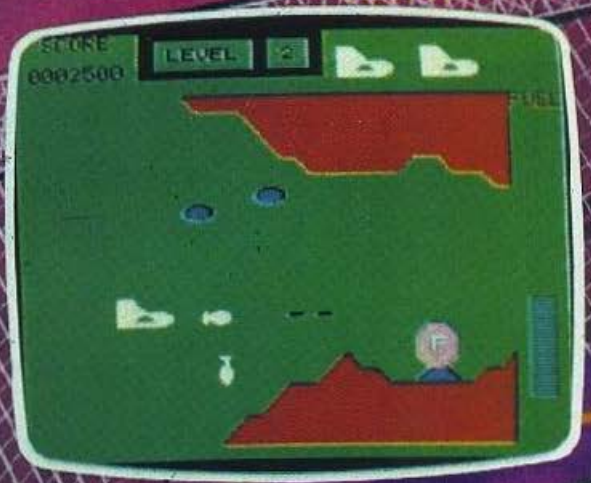
With the Simons' Basic cartridge in place Commodore's Basic can hold its own and indeed feel superior to any other version of the language on the market. Before writing it David Simons drew up a shopping list of all the commands and features he would like to see in his ideal Basic. And here they all are: structured programming features such as Repeat Until and local variables; programming aids such Auto, Trace and Renumber; error trapping commands, extra string handling commands, scroll commands for any direction; and, of course, an extensive range of instructions to deal with sound, high resolution graphics and sprites. There are also a number of novelties like Delay which varies the rate at which a listing is printed, and Disapa which hides a program line as a security aid.

The graphics commands, in particular, do all you could hope for. To mention just a few, Paint fills in an enclosed area, Rec draws a rectangle, while Rot will rotate and expand a predefined shape.

In return for 8K of your RAM Simon's Basic gives you a remarkable number of new software features. Some were sorely needed, others can be considered bonus extras. The pity is that Commodore did not think to rewrite its Basic at the outset incorporating some of these features in the ROM. ■

ORIC (16&48K) TANDY COLOUR (16K)
DRAGON 32

SKRAMBLE



Actual picture of screen on
ORIC 48K

Your mission is to penetrate the enemy scramble system and destroy their headquarters. You will start with three of our latest spacefighters equipped with repeating cannon and twin bomb launcher. If you succeed in evading the elaborate ground defences, you will arrive at the Cave where flying becomes more difficult. In the cave are UFOs, after which you must avoid a hail of meteorites. Very few pilots succeed this far, but if you do, then you must enter the Fortress, followed by the Maze. If you manage to destroy Enemy Headquarters, then your reward will be a more difficult mission! One or two player game.
Machine Language, High Speed, Arcade Action. Full colour graphics with sound. Keyboard or Joystick control.

Available on tape for
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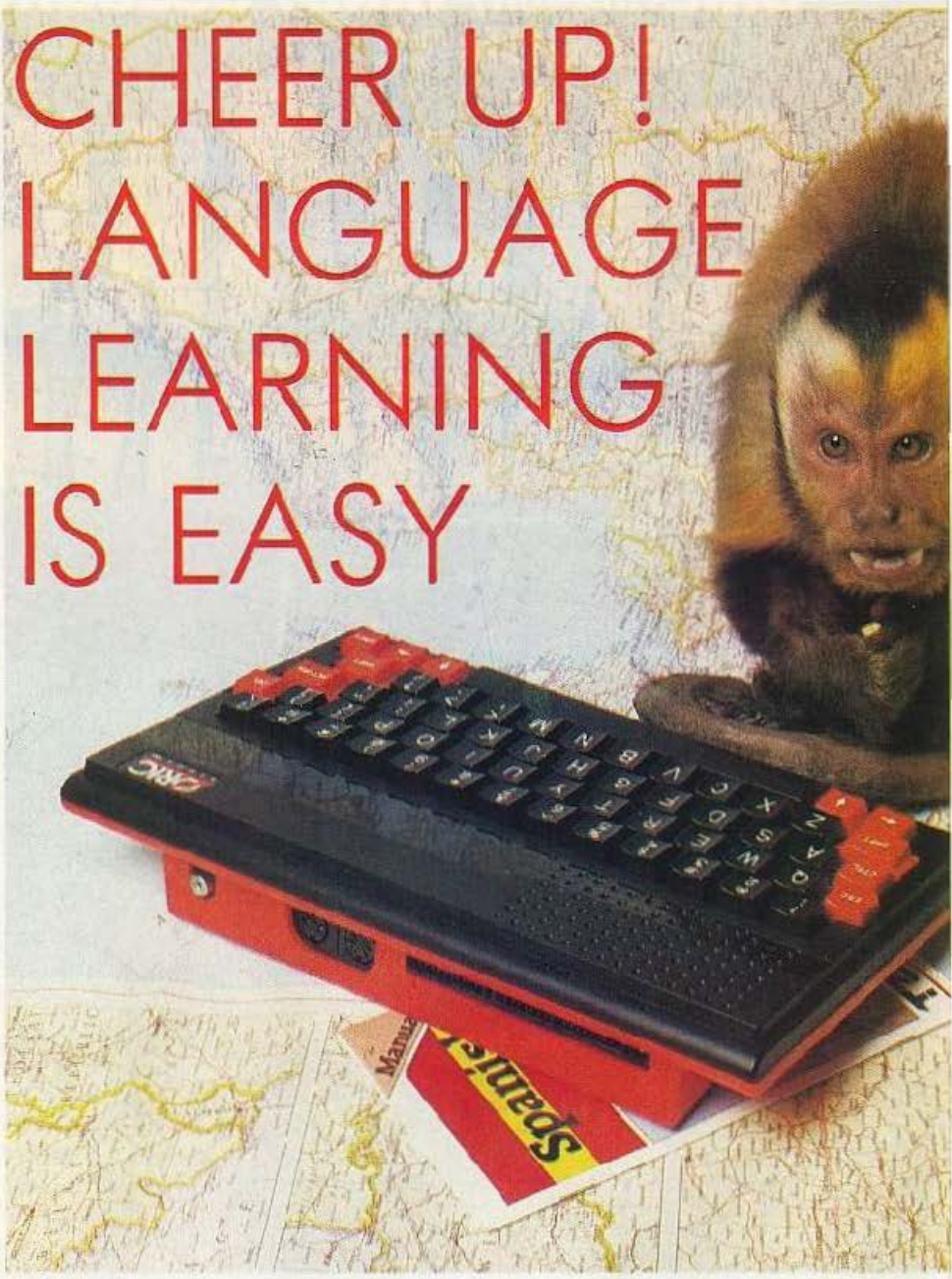
MICRODEAL 1984

CHEER UP! LANGUAGE LEARNING IS EASY



As THE SCREEN CLEARS a surreal message flashes up in front of you — "Imagine" it says "the Edinburgh Tattoo being held on your roof". The idea is that you will use Tattoo as a link word to remind you that the Spanish for roof is tetto.

It sounds crazy but it seems to work and now companies like Acornsoft, Tansoft and Silversoft are racing to produce Linkword programs teaching as many languages as possible before the Summer holidays. Tansoft is in the lead at the moment with French, German, Italian and Spanish learning packages already on sale for the Oric 1 and Atmos. Silversoft is releasing Linkword languages on the Spectrum and Acornsoft has already produced BBC versions with the Electron soon to follow.

Over the next few months Dragon Data and Camputers will produce Linkwords on the Dragon and Lynx, English Software on the Atari and Audiogenic is perfecting versions for the Vic-20 and Commodore 64. All this despite the fact that on paper Linkword does not look very impressive. All it claims to do is teach you a 200 word vocabulary and a crude grammar for whichever language you pick.

Beside the seaside

Why then has it received such an unprecedentedly favourable response from the software houses who reject hundreds of programs for every one they publish? Foreign language teaching programs for computers are nothing new. The Atari among others has had one since 1980. But most of these early programs were expensive and over ambitious. The intimidating eight cassette Atari package ran to £40. Meanwhile two factors have changed.

First the home computer has become an ordinary household good rather than just an exotic toy — potentially a learning machine in every home. The software houses have realised that the millions of families who now have micros are a ready market for a cheap, fun way of learning the ropes of a foreign language before going away on holiday — so long as the price is right — say £5 to £15.

Secondly authors have produced a crop of lively programs which make no pretence to teach a whole language but aim at quickly and painlessly giving a potential tourist enough to get by on.

The Linkword method is only one of these new ideas. French is Fun and German is Fun by CDS are even more approachable — and make good use of graphics. The CDS tapes which cost £6 each for the 48K Spectrum and will soon be available for the Commodore 64 give you a choice of six scenes — house, countryside, beach café, street and school.

When you select one a simple picture appears on screen and then objects materialise out of thin air with their names in English and the foreign language. The beach scene in German is Fun, for instance opens with just the sand and the sky visible.

The sun appears, with the caption "SUN — DIE SONNE" and gradually the whole seaside scene builds up — with even a bouncing beachball and a radio which blares out "I do like to be beside the seaside." Then it tests you by showing the objects and asking you to type in the German name.

One slight problem is that it will only accept the correct letter each time so you find the answer by trial and error. The program is certainly fun and would quickly interest a young child but at the moment there is no guide to pronunciation.

CDS is working on an audio tape for about £4 to go with the program.

The Kosmos language programs — French Mistress, German Master and Spanish Tutor — are more aimed at the needs of schools but are available on the BBC Electron and Spectrum and cost £10.

You really need a teacher to advise you on pronunciation but at least all the accents are displayed over the right letters, unlike the Linkword program. Once you have grown out of the Level A cassette you can shell out another £10 for the Level B which takes you further.

Perhaps because Kosmos aims higher its programs seem less fun and immediately rewarding than the others, but it does give you the capability to create your own lessons and is a massive improvement on learning a language from a book.

The Linkword programs will probably be the lazy tourist's best bet for learning a few words and phrases painlessly. All the versions on the different machines — even the programs for the IBM PC and Junior, Sirius, Apricot, Apple II and Macintosh which ACT is developing are essentialy similar.

Imagine going green

Mike Gruneberg, the University of Wales academic who developed the system, supplied each software house with the volcabulary and link word examples for the four languages developed so far. He is now working on Cantonese, Dutch, Greek, Hebrew, Japanese, Portuguese, Russian and Swedish. You will get very confused if you try learning too many of them.

As it says at one point in Sivlersoft's German Linkword for the 48K Spectrum "Imagine going GREEN after looking at the GRUNEberg Linkword system for too long".

NEXT STOP ROME

You'll never believe the new wonder ingredient that's supposed to teach you foreign languages in a fraction of the time a phrase book takes. Its a monkey with a monocle and a micro. Meirion Jones looks at the new techniques home computers are using to make languages fun, while Mike McCann tries to learn Italian in 10 hours.

THIS YEAR five million Britons will leave these shores to experience the delights of another country, another culture and, more often than not, another language. Doubtless they will return with tales of sun, sea, sand, Italian waiters, German beer-festivals, Spanish hotels and French lorry drivers. But the language, what about the language?

We British do not particularly like learning other langauges. We tend to stick to the colonial belief that our mother-tongue should be spoken — or at least understood — by anyone who should have the good fortune to be addressed by the legendary "Englishman abroad". Last century we conquered an Empire to prove the point. Churchill's "History of the English Speaking Peoples" did not help matters, and now the Common Market has only confirmed our linguistic prejudices.

The result is that many of the five million intrepid explorers will have only a few phrases of the language in question, and these will probably have been acquired from an out of date phrase book during the quieter moments of the channel crossing.

But it is possible to learn the bare essentials of a language — 400 useful words and enough grammar to put them into simple sentences — and learn them quickly. That, at least, is the claim made by Tansoft of Cambridge. In fact, Tansoft claims that the computer-based course can teach the basics in ten hours, as opposed to 40 hours using more familiar methods.

For £13 you get two tapes and a small manual-cum-glossary. One tape contains 10 computer programs, each containing one section of the course, while the other is an audio tape to teach you the pronunciation.

An ugly brute

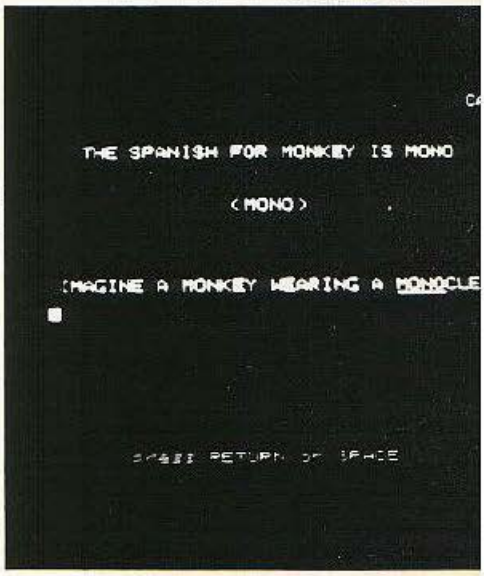
The Gruneberg Linkword Language Course (well, the name makes a welcome change from "Ultima Zone" or "House of Death") was designed by a professional psychologist, Dr. Michael Gruneberg, of University College Swansea, and uses an unusual but effective method to jog the memory and make learning fun. Dr. Gruneberg is in fact something of an authority on memory, having published numerous papers on the subject since 1967. Now he has teamed up with a fellow academic from the relevant language department in Swansea and computerised the lot.

The course works by giving you some strange instructions, such as:

"The Italian for Ugly is Brutto.
Imagine looking at an *ugly brute*"

You then do precisely this for ten seconds and then go on to the next word. After ten words the computer gives you a quick test translate from Italian into English and English into Italian. You then sit back in your chair with pleasure and surprise as you realise that the system does work.

Concentrate on the message below for 10 seconds then turn over the page.



The course is divided into 10 sections, each one teaching you about forty words using this routine, interspersed with some easy-to-pick-up rules of grammar, and before you know it you are constructing your own sentences. Each section takes about an hour to master, including listening to and repeating the pronunciation on the audio tape, hence Tansoft's ten-hour claim. It is advisable, though, not to cram them together — one a day for two weeks is probably what the Doctor had in mind.

The Earth is black

Some of the sentences you are asked to translate are mildly eccentric; "the Earth is always black", for example, while others are worse than the "postillion-struck by lightning" variety. How many times have you had the urge to say "The bonnet and the wheel are very hard, but why is the steering wheel not clean?" There are two reasons for this apparent shortcoming: to illustrate the rules of grammar and to avoid the parrot-fashion recital of stock words and phrases. Some of the more outlandish examples actually seem to stick in the mind because they are so ludicrous. At any rate you quickly progress to such useful bits of information as "In July, August and September the water is very dirty".

The Gruneberg system uses a neat catch-all visual image for words which sound the same in English as they do in another language. The Italian for piano is "pianoforte", so you are invited to imagine a pianoforte covered in spaghetti. The French equivalent is a piano at the top of the Eiffel Tower (le piano). German and Spanish rely on the National flag — imagine a mouse on the German flag (die maus).

Some of the links do confuse matters, though. It would surely have ben easier to link

(continued on next page)

Mike Gruneberg does not claim that Linkword will be right for everybody, "its not the only way" he says "but it is a different way".

His imagination seems to be a strange place infested by salmon leaping over bullfighters, bakers being chased by bees, witty lobsters and of course monkeys, at least to judge by his Linkwords.

The Japanese word for knickers is pronounced "hands upon", or so I am told. I dread to think what Mike Gruneberg will use as a Linkword for that.

There is considerable variation in the prices the companies are charging. For the programs which most of them are supplying with an audio cassette and a leaflet. In each case all the software house had to do was write a relatively simple program for a particualr machine.

Considering they look almost identical on screen it is hard to understand why Acornsoft charges £15 to Electron and BBC owners while Spectrum users need only pay £10 to Silversoft.

So now you know the Spanish for monkey using the Linkword principle.

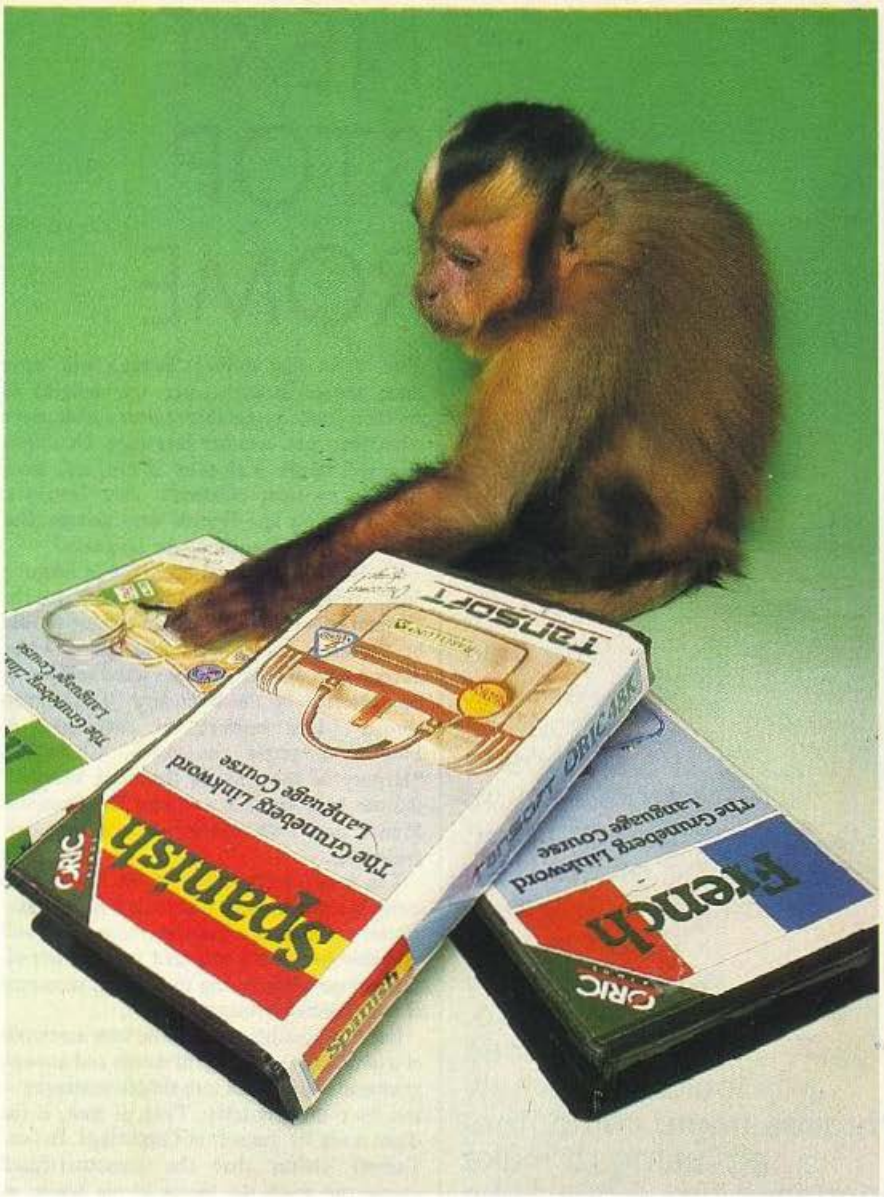
(continued from previous page)
red and white with a well-known Italian drink, rosso and bianco, than to a "bank all painted white". And I remembered good, bad and ugly by thinking of the film rather than the linkword.

One slightly disappointing aspect of Transoft's package is that it hardly uses the computer's graphic or sound capability. A brief flash of the Italian flag at the start of lesson 1 and then back to a simple 2-colour text display. Sound is similarly limited; just a single bleep or musical note as each question is answered. Gruneberg believes that graphics and sound could prove to be a distraction from the learning process, and points to academic research to support him.

Another surprise is that the computer performs each test in exactly the reverse order to the learning order. My immediate reaction was that the programmer was being lazy and didn't want to write a random-order test routine. After a while, however, I found myself remembering a difficult word because it came before or after a more familiar one. And for numbers or days of the week a set order is an obvious advantage. The keep-it-simple philosophy triumphs again.

Operating the program is easy — just a matter of pressing Return when you are ready to go on to the next page or the space bar if you want to have the recommended 10 seconds to concentrate on the suggested image. This makes the courses ideal for those who are not familiar with a keyboard. You can, however, type in your answers if you want to, though the machine will treat these in the same way as before. It does not give you a chance to correct a wrong answer, for example.

The computer takes most of the tedium out of learning a language. In fact, it acts in more or less the same way as a school class mate does — testing and re-testing a list of words you have committed to memory. I wonder if Transoft is going to incorporate this feature into another program aimed at schoolteachers, which would enable them to write in a list of words — or even chemical formulae — and let the pupils test and assess themselves. I certainly found this package a quick way of learning — quicker than the printed page.



One obvious disadvantage of a computer-based learning system is especially apparent with language. Not many people will take their computers on holiday. Once separated from their Orics, anyone who has used this system has to rely on the glossary in the handbook, which only gives English-to-Italian translation of the 400 word vocabulary. It certainly cannot be used as a tourist phrase-book or dictionary, nor even as a guide to the structure of the course. This seems to be penny-pinching: anyone who uses the system will have to buy a phrasebook if they really want to be self-sufficient abroad, and I would have expected University academics to realise this.

Main use is for tourists

For the most part the courses have been designed to teach you words you will actually need to use abroad, whether you are sunning yourself on the beach, ordering a meal in a restaurant or fuming in a broken-down car. The one exception to this is the section dedicated to the business man. The business vocabularly — words like shop assistant, price, secretary and holidays — is probably more use for small talk and the expense account rather than the boardroom.

The audio tape is probably the most important part of the package. There is a world of difference between the spoken and the written word. The Gruneberg system tells you not to listen to the pronunication until you are satisfied with your grasp of the computer-written word. This strikes me as being unadventurous. Most cassette players have remote control; it would have been a nice idea to use the computer to trigger the audio tape (with the playback socket disconnected, of course), and so learn on a real audio-visual system. A refinement for the future, perhaps.

The Gruneberg Linkword System is surprisingly efficient at cramming in short facts in rapid succession. But it should not be taken too seriously: it is certainly not up to 'O' level standard, though it might conceivably replace the first few chapters of a school textbook. Its main use will be for tourists who want to learn the bare essentials of a language — just enough to get by for a week or two on the Costa del Sol. It's certainly enough to make me want to convert my assets into French Francs and parler with these lorry drivers! ■

ON A TOP SECRET COMPUTER DESIGN LABORATORY NEAR ORLANDO, FLORIDA...
JIM, THIS IS SCOTT ADAMS. THE PROJECT IS READY TO BEGIN! SEND THEM TO ME NOW!
OKAY! WE'LL GET THEM MOVING!
I'D BETTER BRING SOME EXTRA WEBBING! THIS LOOKS LIKE A BIGGY!
HULK ALWAYS WANTED FLORIDA VACATION!
WHERE'S FLORIDA?!
BEN, GET READY FOR A REAL FIRST. THIS TIME WE'RE GOING ON A COMPUTER ADVENTURE!
BUT STRETCHO... I THOUGHT WE WAS GOING TO FLORIDA!?
BY THE EYE OF VISHANTI, I'VE BEEN MANY PLACES, BUT NOW I SEE THAT SCOTT ADAMS BECKONS AND I MUST GO!
MEANWHILE, BURIED DEEP IN A FLORIDA SWAMP...
LITTLE DO THOSE MARVEL CHARACTERS KNOW WHAT I REALLY HAVE PLANNED FOR THEM!
NEWS FLASH! MARVEL SUPER HEROES ORDERS TO U.K. IN SEARCH OF COMPUTER ADVENTURERS. E.T.A. MAY 1st ADVENTURE INTERNATIONAL

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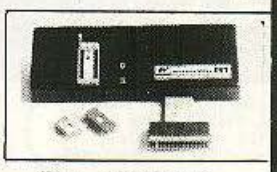

In use at various labs incl. Sinclair Research

Eprom programmer for the 2516, 27XX single supply families, yes, even the 27128 from Intel. Check, Read, Program – Verify all or part of Eprom.

So immensely user friendly you'll hardly need the manual. Designed for the beginner but includes a single key entry route for the professional. Supplied as firmware, the m/c driver routine alone is worth more than the price of BLOPROM-81. No personality Cards, or other additions, just a ZX81. Several inbuilt safety features. On-board Vpp generation. 28pin ZIF socket. Cabled connector and extender plug. ABS case.

```
STATUS    NO. OF SYSTEM —HEX
          EPROM TYPE —27128
          RAM START ADDR — 4000
          EPROM ST. ADDR — 0000
          JOB LENGTH — 4000
          TASK — CHECK

WHICH TASK DO YOU WISH TO DO
W) CHECK THAT EPROM IS CLEAN
X) READ THE CONTENTS OF EPROM INTO
   RAM
Y) BLOW AN EPROM WITH DATA FROM
   RAM
Z) VERIFY THAT EPROM DATA IS THE SAME
   AS IN RAM
Q TO QUIT ..............R TO RESTART
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B    H    PQI    WXYZ
```

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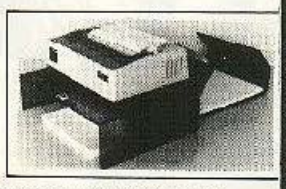

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ADVERTISERS ANNOUNCEMENT

A YEAR IN THE LIFE A SOFTWARE COMPANY

WIDGIT SOFTWARE, one of the first software houses to write for very young children, looks back on its progress in the first year and assesses its future.

From a small start a year ago, WIDGIT Software is now to be found in almost every High Street and has achieved a high reputation for quality and interesting software for children. During the year they have produced seven titles and another four will be ready in the spring. One of Widgit's titles, QUICK THINKING, was chosen by the Mirror Group Newspaper's software company MIRRORSOFT, for its launch in November 1983, and the Commodore 64 version reached number 7 in the Websters charts — an unusual feat for an educational tape.

LEARNING THROUGH PLAY

One of Widgit's main concerns is to write good quality entertaining material which gives good value for money without sacrificing standards. All the programs are essentially games, but each has clear educational aims and a sound basis. The idea is that children learn much better through play. The 'on screen' images and the quality of the graphics must be appealing, full of colour and, where appropriate, animated. High quality use of graphics must be appealing, full of colour and, where appropriate, animated. High quality use of graphics has become a feature of Widgit products and they firmly believe that educational material just the same quality of display as other programs. As far as programming is concerned, Tina says

"We use a mixture of machine code and basic: machine code for the graphics and basic to get a good degree of flexibility. We want to allow for a variety of levels of play and can maintain the interest of a child as his or her skills develop."

HOW IT ALL STARTED

Kate and Simon Detheridge's enthusiasm for computers was the initial driving force behind Widgit Software. At the ages of 2 and 3 they were ready and keen to use computers, but there was no commerical software available. Their parents Mike and Tina had done quite a good deal of programming on business machines, but when the SPECTRUM arrived with its low price and super graphics capabilities, they saw a market potential and immediately set about writing material. With a generation gap growing around computers Mike and Tina were anxious to write material which young children and their parents would use together. They hoped to persuade parents to use computers, and that once they had had 'hands on' experience the computer would take its rightful place as a standard domestic utility item.

Using their experience as teachers, parents and programmers they designed their first set of four tapes for pre-school and infant children. When these were produced in May 1983, Mike and Tina had little idea how the business would develop. They were confident that the market was there and that their programs had the quality to be a commerical success. This confidence was fortunately shared by W.H. Smiths who promptly put Widgit Software on its shelves where it has been selling very successfully every since.

"Simon and Kate testing out some of the programs"

By the middle of August a new tape PATHFINDER was ready for release, and with several ideas in the pipeline, Mike and Tina decided it was time for expansion. Lucas Fowler joined them as a programmer, Vivienne Harling as an educational adviser, and at the same time they were approached by Mirrorsoft. The tape that the team were working on at the time was QUICK THINKING and was published by Mirrorsoft in November.

By christmas the whole Widgit range was available in Boots, and with an export market starting to take off, Widgit was on a firm footing to enter 1984.

NOW AND ONWARDS

One of Widgit's best liasons has been with Gordon Askew. Gordon is Head of a primary school in Cheshire and has a great deal of very relevant educational experience. He has made important contributions to Widgit including their most recent release HUMPTY-DUMPTY. Work is now in hand for four more releases, two of which are due for publication very soon. Some programs will be released through MIRRORSOFT and others under the WIDGIT label.

"We enjoy working with Mirrorsoft," says Mike, "apart from the commercial benefit a great deal is gained from the interchange of ideas which we get during the development."

Widgit now feel that they have a broad base of experience and talents to stay in the forefront of educational software

THE PROGRAMS

COUNTING, ADDING & SUBTRACTING and QUICK THINKING are tapes which develop the concept of number from a very early beginning. Care was taken to ensure that the very first program on COUNTING could operate from the very simplest level and the 3 next programs on the tape develop from this. ADDING & SUBTRACTING makes sure the process of counting can effectively lead into simple sums. There are 3 programs on this tape, which with its smooth scrolling and good, clear graphics has been uniformly well recieved by the press and schools.

"Outstanding programs for Infant schools" (Ed. Computing)

"My favourite education tape" (ZX Computing)

QUICK THINKING takes arithmetic a stage farther; it is now necessary to do the sums mentally. The levels are carefully graded from adding single digit numbers to fast time trials which stretch adults! The other program on the tape introduces multiplication tables and number sequencing in a magnificant robot machine.

SHAPE SORTER is a tape to develop visual perception and its simple 2 key operation makes it suitable as a first tape for children from about 2. The first program is simple shape recognition and the second, HOUSES, which can be used as the child gets slightly older is a 'spot the difference' game. On the second level this can be quite hard but there is a lovely reward. The third program is on size sorting.

"they are superb early learning programs" (ED. Computing)

ALPHABET is a program for children as soon as they can learn to recognise letters on the keyboard. Clear, full screen pictures illustrate each letter and there is an option to relate lower to upper case letters. It is a nice program for parent and child to start using computers together.

PATHFINDER (for ages 4 to 9) is a series of 4 graded maze games featuring animals. All the mazes are randomly generated and no two are ever the same. They deal with important basic concepts — up, down, left and right, and begin to develop the ability to plan in advance. KANGAROO, the second program leads the player in the direction of simple programming. The graphics are bold and brightly coloured and there is a nice, but not excessive use of sound. Again the reviews of this tape have been very good:

"These games should prove very entertaining to play as well as providing a very real challenge" (Crash Magazine)

"Well done Widgit. A very real application for a home computer, cleverly executed and which does not cost the earth" (Home Computing Weekly)

The HUMPTY-DUMPTY MYSTERY and WHO KILLED COCK ROBIN are two programs on the latest tape from Widgit only recently released, and is suitable from early readers to about 10 year olds. This tape contains 3 programs designed to develop logical thinking and memory. There are 2 games to discover which of the King's 12 men pushed Humpty off the wall, in the first by asking questions and/or guessing and in the second, the player gets a glimpse of the culprit but then has to remember and describe him Cock Robin asks the daunting question "Can Sparrow's confession be believed?" and through a process of logic and using the clues provided the player must discover WHO killed Cock Robin, WHERE and WHEN. These are very appealing games and are certainly not exhausted after one or two playings. They lead to a lot of discussion when played by a group of children and appeal to quite a wide age range.

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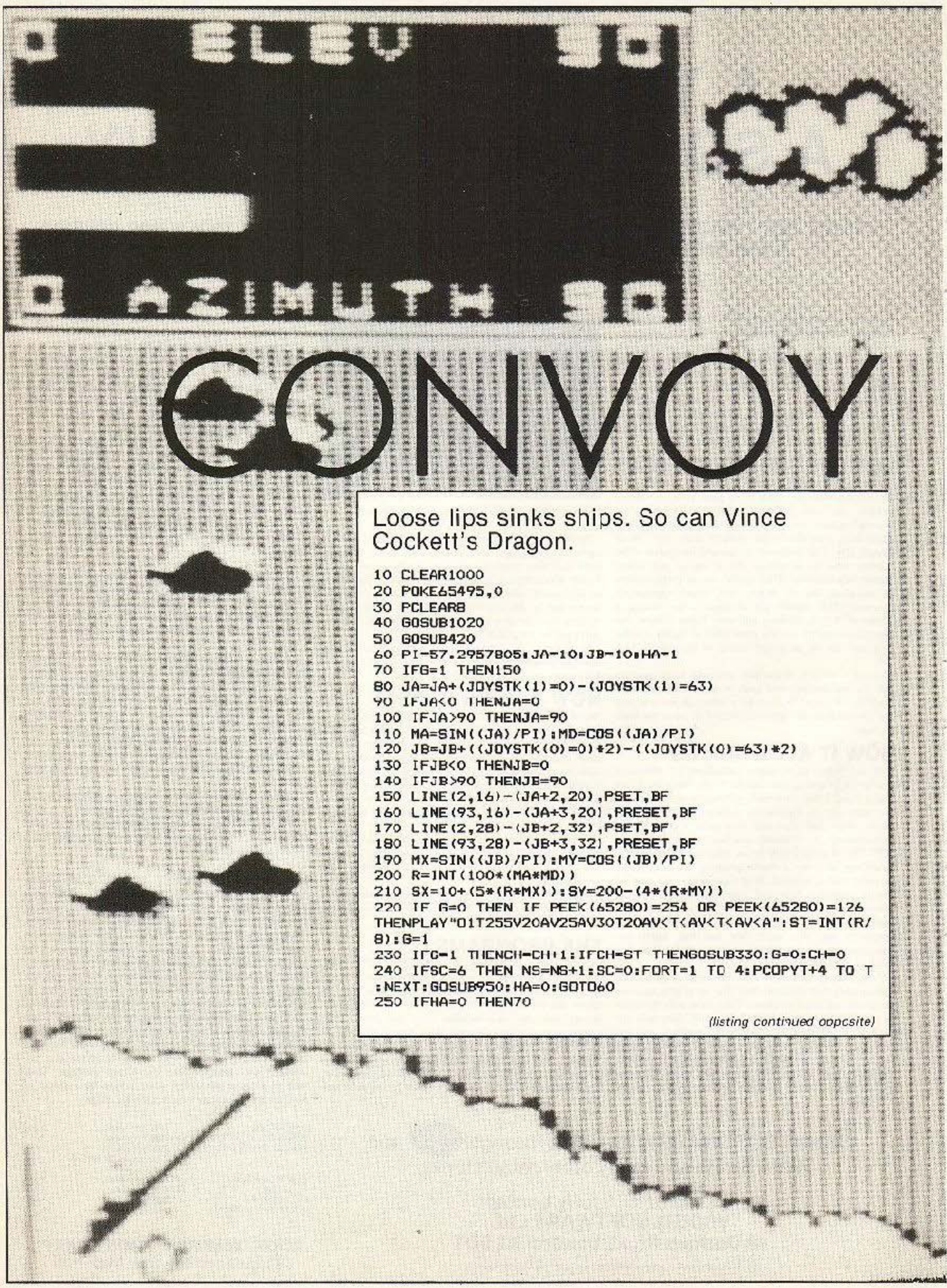
LOOK SHARP for 'LOOK SHARP'
Widgit's next title from Mirrorsoft

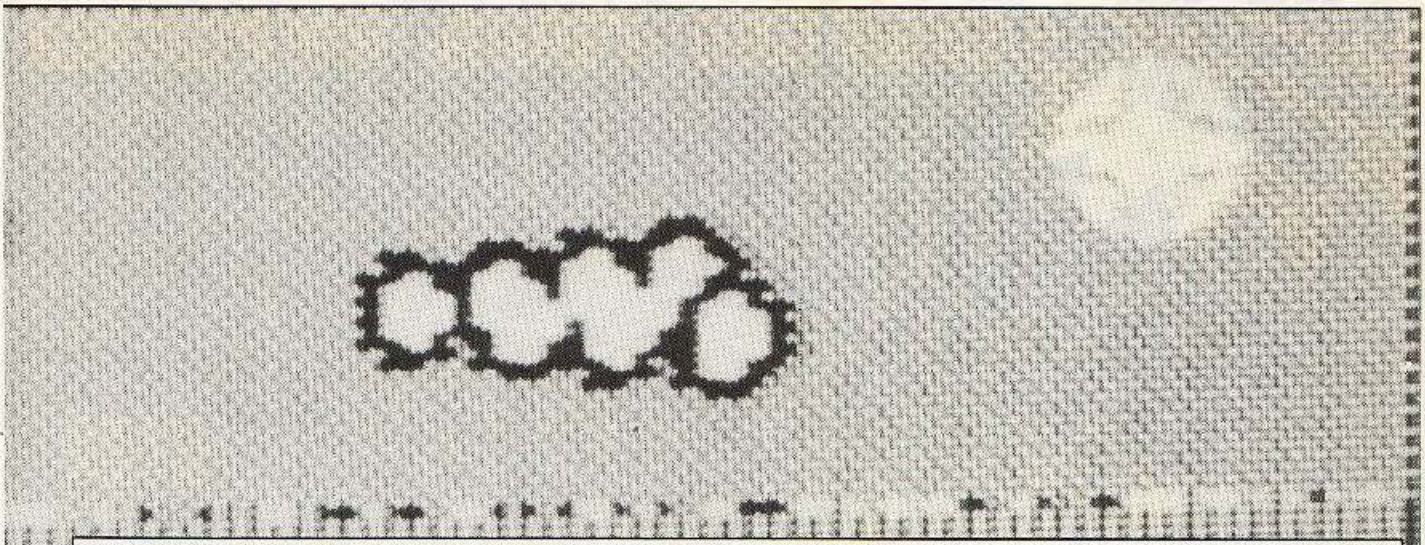


CONVOY

Loose lips sinks ships. So can Vince Cockett's Dragon.

```
10 CLEAR1000
20 POKE65495,0
30 PCLEAR8
40 GOSUB1020
50 GOSUB420
60 PI=57.2957805:JA=10:JB=10:HA=1
70 IFG=1 THEN150
80 JA=JA+(JOYSTK(1)=0)-(JOYSTK(1)=63)
90 IFJA<0 THENJA=0
100 IFJA>90 THENJA=90
110 MA=SIN((JA)/PI):MD=COS((JA)/PI)
120 JB=JB+((JOYSTK(0)=0)*2)-((JOYSTK(0)=63)*2)
130 IFJB<0 THENJB=0
140 IFJB>90 THENJB=90
150 LINE(2,16)-(JA+2,20),PSET,BF
160 LINE(93,16)-(JA+3,20),PRESET,BF
170 LINE(2,28)-(JB+2,32),PSET,BF
180 LINE(93,28)-(JB+3,32),PRESET,BF
190 MX=SIN((JB)/PI):MY=COS((JB)/PI)
200 R=INT(100*(MA*MD))
210 SX=10+(5*(R*MX)):SY=200-(4*(R*MY))
220 IF G=0 THEN IF PEEK(65280)=254 OR PEEK(65280)=126
THENPLAY"O1T255V20AV25AV30T20AV<T<AV<T<AV<A":ST=INT(R/
8):G=1
230 IFG=1 THENCH=CH+1:IFCH=ST THENGOSUB330:G=0:CH=0
240 IFSC=6 THEN NS=NS+1:SC=0:FORT=1 TO 4:PCOPYT+4 TO T
:NEXT:GOSUB950:HA=0:GOTO60
250 IFHA=0 THEN70
```

(listing continued opposite)



THE GAME CONVOY is a shooting game with a slight difference. Positioned at the lower left corner of the screen is an artillery gun overlooking the sea. Sailing close in shore is a convoy of enemy ships. By aiming the gun, using the joystick, the convoy has to be knocked out.

However, the range of the shell can be varied, as in a real gun, by varying the elevation. Also the further away from the gun the target is, the longer the shell will take to reach it thereby allowing the ship to sail away from the original target area.

The game is in Mode 4 Black and White. However, by working the first part of the picture drawing routine in Mode 3 and clearing the screen to either colour 6 or 7 and then switching into Mode 4, a blue background can be achieved.

Furthermore if, while still in Mode 3, lines are drawn across the picture, using the alternate colour to the one already chosen to clear the screen, every second line position down the screen an extra pale blue/grey background can be provided.

Note also that because two modes have been used to build the picture, two different resolutions of drawing can be achieved. This has been used to create the textured clouds in the game.

(listing continued from opposite page)

```
260 FORT=1 TO 6:TA(T,1)=TA(T,1)+2:TA(T,2)=TA(T,2)+RND(
3)-2
270 IFTA(T,1)>235 ANDTA(T,3)=0THEN1260
280 IFTA(T,2)<48 THENTA(T,2)=48
290 IFTA(T,2)>150 THENTA(T,2)=150
300 GOSUB1000
310 NEXTT
320 GOTO70
330 IFSY<48 THEN400 ELSEPLAY"T20V30O4V30CV20CV10CV5C":
 FORJ=1 TO 4:GET(SX,SY)-(SX+7,SY+7),BL,G:PUT(SX,SY)-(S
X+7,SY+7),SP,PSET:FORDE=1 TO 50:NEXTDE:PUT(SX,SY)-(SX+
7,SY+7),BL,PSET:NEXTJ
340 FORT=1 TO 6
350 IFTA(T,3)=1 THEN370
360 Q=SX-TA(T,1)+4:IFQ<16 ANDQ=>0 THEN380
370 NEXTT:RETURN
380 Q=SY-TA(T,2):IFQ<4 ANDQ=>0 THEN390 ELSE370
390 IFT=7 THENRETURN ELSE TA(T,3)=1:SC=SC+1:PUT(SX,SY)
-(SX+7,SY+7),BL,PSET:PUT(TA(T,1),TA(T,2))-(TA(T,1)+17,
TA(T,2)+11),SL,PSET:RETURN
400 FORT=1 TO 4:DRAW"BM110,44C1NR4U4R4D4BR4NU4R4NU4BR6
U4L2R4BD4BR8;NR4U4R4D4BR4U4NR4D2NR4D2BR12;R4L2L4U2R4BD
4BR4NU4BR4U4NR4D4R4U2NL2D2BR4U4D2R4U2D4BR6J4L2R4":PLAY
"T255O4ABCDEFGO5ABCDEFG":PUT(110,38)-(210,44),A,PSET:N
EXT:RETURN
410 RETURN
420 PMODE3:PCLS7
430 DATA129,131,135,138,131,130,143,132,143,133,138,14
3,138,143,129,131,133,138,143,138
440 DATA133,143,143,138,143,138,143,129,141,133,138,14
3,138,143,133,143,133,139,141,137
450 DATA133,143,143,138,143,138,143,133,134,133,138,14
3,138,143,133,143,133,143,138,143
460 DATA132,140,143,130,140,136,143,133,143,133,143,13
4,135,143,132,140,133,143,138,143
470 DATA174,170,174,234,184,126,176,59,224,7,0,0,128,3
,192,6
480 DATA36,36,36,36,60,153,129,231
490 DATA63,255,252,63,251,248,63,249,241,63,250,227,63
,253,69,63,253,142,63,254,29,63,230,43
500 DATA63,226,55,63,192,115,63,208,235,63,129,221,63,
131,173,63,135,70,63,174,146,63,221,56
510 DATA63,187,121,63,119,57,63,239,51,62,223,47,61,19
1,133,59,127,207,29,255,255
520 FORT=2 TO 9:READA,B:POKE1537+(T*32),A:POKE1538+(T*
32),B:NEXT
530 DIMBO(20),SL(20),BL(2),TA(6,3),A(36),SP(2)
540 GET(4,0)-(21,11),BO,G
550 GET(4,20)-(21,31),SL,G
560 FORT=0 TO 7:READA:POKE1536+(T*32),A:NEXT
570 GET(0,0)-(7,7),SP,G
580 PCLS6
590 COLOR7
600 FORT=0 TO 48 STEP2
610 LINE(0,T)-(255,T),PSET
620 NEXT
630 FORT=0 TO 31:POKE1536+(48*32)+T,RND(128)+127:NEXT
640 A$="U2RU2RURUR2DR2D2RD2
650 B$="D2RD2RDRDR2UR2U2R2U2
660 DRAW"BM90,20;C5":GOSUB690
670 DRAW"BM160,30;":GOSUB680:GOTO690
680 DRAWA$+A$+A$+A$+A$+"BM-4,+6;"+A$+"BM-36,-3;"+B$+B$+B$
+B$:RETURN
690 PAINT(96,20),8,5:PAINT(102,20),8,5:PAINT(124,20),8
,5
700 PAINT(166,30),8,5:PAINT(172,30),8,5:PAINT(194,30),
8,5
710 Y=150
720 DRAW"BM0,150;C5"
730 LINE-(X,Y),PSET
740 X=X+2:Y=Y-RND(6)+4
750 IFY<194 THEN730
760 PAINT(5,190),8,5
770 PMODE4
780 FORT=2 TO 8 STEP2
790 CIRCLE(230,15),T
800 NEXTT
810 GU=1536+(168*32)
820 FORT=0 TO (22*32) STEP32:READA,B,C:POKEGU+T,A:POKE
GU+T+1,B:POKEGU+T+2,C:NEXT
830 LINE(0,0)-(96,48),PRESET,BF
840 LINE(0,0)-(96,48),PSET,B
850 LINE(2,2)-(94,46),PSET,B
860 LINE(0,0)-(255,192),PRESET,B
870 DRAW"BM4,8;NR4U4R4D4BR21;U4NR4D2NR4D2R4BR4NU4R4BR4
U4NR4D2NR4D2R4BR6H2U2BR4D2G2BR23;R4U4L4D2R4D2BR4NR4U4R
4D4
880 DRAW"BM4,44;NR4U4R4D4BR11;U2NR4E2F2D2BR4NR4E4NL4BD
4BR4NU4BR4U4F2NDE2D4BR4NU4R4NU4BR6U4NL2R2BD4BR4U4D2R4U
2D4BR11;R4U4L4D2R4D2BR4NR4U4R4D4
890 GET(110,38)-(210,44),A,6
900 LINE(8,184)-(33,159),PRESET
910 LINE(7,184)-(32,159),PRESET
920 LINE(6,184)-(32,158),PRESET
930 SCREEN1,1
940 FORT=1 TO 4:PCOPYT TO T+4:NEXTT
950 FORT=1 TO 6
960 GOSUB970:NEXT:RETURN
```

(listing continued on page 89)

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(listing continued from page 87)

```
970 TA(T,1)=(RND(21)*2)-21
980 TA(T,3)=0
990 TA(T,2)=RND(100)+48:IFTA(T,2)<50 THEN990
1000 IFTA(T,1)>2 ANDTA(T,3)=0 THENPUT(TA(T,1),TA(T,2))
-(TA(T,1)+17,TA(T,2)+11),BO,PSET
1010 RETURN
1020 CLS3:FORT=32 TO 160 STEP32:PRINT@T,STRING$(32,207
);:NEXT
1030 PRINT@480,STRING$(31,233);
1040 PRINT@0,STRING$(32,233);
1050 FORT=32 TO 448 STEP32
1060 PRINT@T,CHR$(233);:PRINT@T+31,CHR$(233);:NEXT
1070 POKE1535,233
1080 P=1159
1090 FORT=0 TO 19:READA:POKEP+T,A+64:NEXT
1100 P=P+32:FORT=0 TO 19:READA:POKEP+T,A+64:NEXT
1110 P=P+32:FORT=0 TO 19:READA:POKEP+T,A+32:NEXT
1120 P=P+32:FORT=0 TO 19:READA:POKEP+T,A+32:NEXT
1130 A$=STRING$(30,42)+"YOUR ORDERS:-ARE TO SINK THE E
NEMY CONVOY SAILING CLOSE TO YOUR SHORES BY USING YOUR
 GUN POSITIONED AT THE BOTTOM LEFT OF THE SCREEN. USE
THE RIGHT JOYSTICK TO CONTROL THE BEARING & AZIMUTH AN
D THE BUTTON TO FIRE"+STRING$(12,175)
1140 PRINT@303,"BY";:PRINT@362,"VINCE  COCKETT";
1150 PRINT@456,"INSTRUCTIONS (Y/N)";
1160 I$=INKEY$:IFI$="" THEN1160
1170 IFI$="N" THEN1240
1180 IFI$<>"Y" THEN1160
1190 FORT=1 TOLEN(A$)
1200 SO=1+(PEEK(1502)AND11)
1210 PLAY"T10;V5;"+STR$(SO)
1220 PRINT@449,MID$(A$,T,30);
1230 NEXT
1240 PRINT@454," PLEASE WAIT A MOMENT ";
1250 RETURN
1260 PRINT@454,STRING$(24,175);
1270 IFSC+(NS*6)>3 THENPRINT@295,"WELL DONE GUNNER****
";:ELSEPRINT@295,"BACK TO THE TRENCHES";
1280 PRINT@359,"YOU SANK "SC+(NS*6)"SHIPS";
1290 FORD=1 TO 1000:NEXTD
1300 PRINT@455,"PRESS SPACE TO PLAY";
1310 IFINKEY$<>" " THEN1310
1320 FORT=1 TO 4:PCOPYT+4 TO T:NEXT
1330 SCREEN1,1
1340 GOSUB950
1350 HA=1:G=0:NS=0:SC=0:GOTO60
```

■

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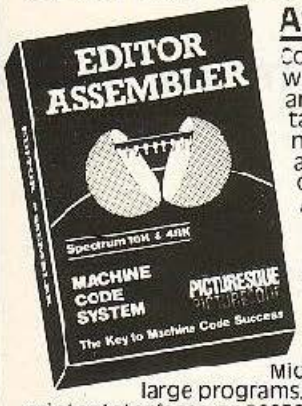

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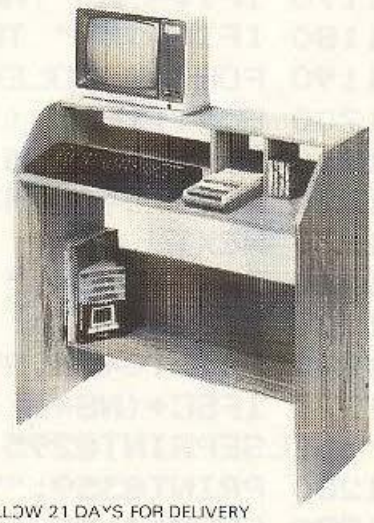

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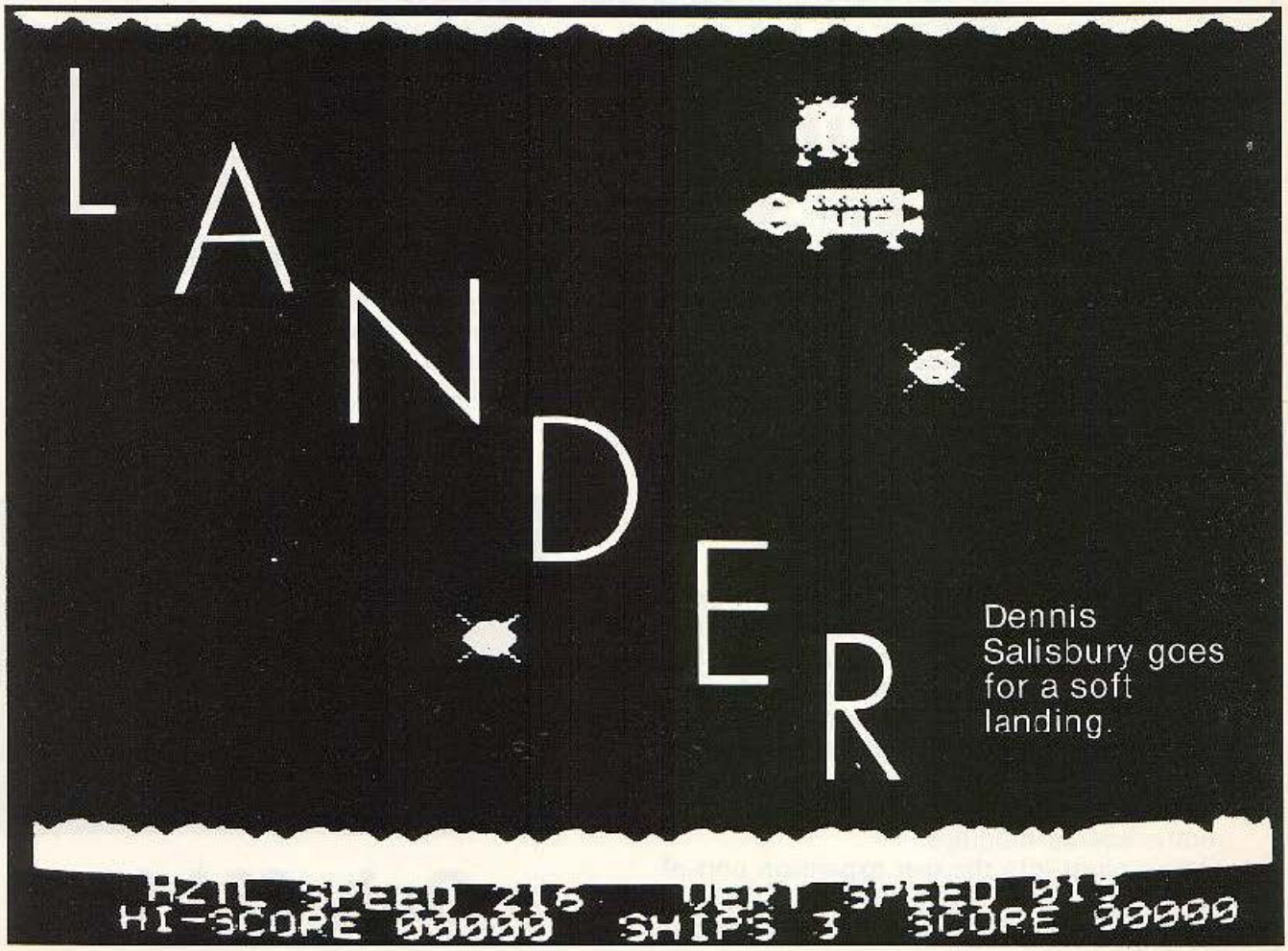
Listing 1.

```
2 DOKE#9C,#9A0
5 GOSUB 1000
10 PRINTCHR$(6)
15 CLS:INK 7:PAPER 4:PRINT CHR$(17)
30 PLOT 5,1,10:PLOT 5,2,10
40 PLOT 11,1,"ORIC  LANDER"
50 PLOT 11,2,"ORIC  LANDER"
60 PLOT 11,3,"____________"
70 PLOT 10,5,"By D.Salisbury"
75 PLOT 10,6,"______________"
80 PLOT 3,10,"Controls :-"
90 PLOT 6,12,"Cursor Up   -   Thrust Up"
100 PLOT 6,14,"Cursor Down -   Thrust Right"
110 PLOT 6,16,"Cursor Left -   Thrust Left"
130 PLOT 6,18,"P  -  Pause On"
135 PLOT 6,20,"S  -  Pause Off"
140 PLOT 9,24,"Press any key to start"
150 PLOT 8,24,12
190 GET D$
200 INK0:PAPER7:HIRES
205 INK7:PAPER0:PRINT CHR$(17)
207 CALL#1978
210 CALL#115D
211 POKE#8C,3:POKE#87,0
212 POKE2,2:POKE1,255
213 POKE9,50:POKE4,255
214 POKE11,250:POKE7,250
215 POKE#59,5:POKE#BFD1,53
220 CALL#12D8
230 RESTORE
240 FOR I=0 TO 7
250 READ A
260 NEXT
265 X=0:Y=0
270 FOR I=1 TO 53
280 READ A$
290 CURSET 50+X,70+Y,0
300 CHAR A$,0,1
310 X=X+7
320 IF I=24 THEN X=-20:Y=30
330 NEXT I
335 DATA 0,63,0,0,0,0,0,0
340 DATA 80,82,69,83,83,32,73,32,70,79,82,32,73,78,83,
84,82
350 DATA 85,67,34,73,79,78,83,80,82,69,83,83,32,82,69,
84,85
360 DATA 82,78,32,70,79,82,32,65,78,79,84,72,69,82,32,
71,65,77,69
400 GET A$
410 IF ASC(A$)=73 THEN IE=1:GOTO 15
420 IF ASC(A$)<>13 THEN 400
430 FOR I=0 TO 4
440 POKE#66+I,48
450 POKE#BFDA+I,4E
460 NEXT I
470 POKE#80,3
475 CALL#1978
480 CALL#1177
490 GOTO 211
900 END
1000 FOR I=0 TO 7
1010 READ X
1020 POKE 46840+I,X
1030 NEXT I
1050 RETURN
```



Dennis Salisbury goes for a soft landing.

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Your relative speeds are shown on the horizontal and vertical speed indicators. To land safely your vertical speed must be below about 25 and both feet of your spacecraft must be on the flat area. If you land successfully you will be given a certain number of points depending on how fast you did it, and the next landing will be harder.

You are given five ships to start with and you will lose a ship if you hit the mothership or a satellite, fly into the acid clouds at the top of the screen or land in the wrong place. You

(continued on page 93)

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Listing 2.

```
20 PRINT "INPUT START ADDRESS IN HEX"
30 PRINT "(PRECEDED BY A HASH CHARACTER)"
40 INPUT S
50 PRINT "READ OR WRITE (R/W)"
60 INPUT A$
70 IF A$ = "R" THEN GOTO 135
80 FOR N=S TO #1A00
90 PRINT HEX$(N),
100 INPUT I
110 POKE N,I
120 NEXT
130 STOP
135 PRINT "PRESS ANY KEY"
140 FOR N = S TO #1A00 STEP 10
150 PRINT HEX$(N);" - ";
160 FOR B=0 TO 9
170 PRINT HEX$(PEEK(N+B));" ";
175 X$=KEY$:IF X$ = "" THEN 175
177 X$=""
180 NEXT
190 PRINT
200 NEXT
```

(continued from page 91)

will also lose a ship if your vertical speed is too high when you land or if the mothership reaches the acid clouds before you land.

The controls are: cursor up — thrust up; cursor left — thrust left; cursor down — thrust right; p — pause on; s — pause off.

To enter the program you must first type in the machine code by running the short program in listing 2. Should you wish to save the machine code on tape at any time you should type:

CSAVE "MC", A#1000, E#1A00 [RETURN]

and then type:

CLOAD "MC", A#1000, E#1A00 [RETURN]

when you wish to continue. When you have entered all the machine code type

NEW [RETURN]

and then enter the Basic program in listing 1.

You can run the program

Then type:

DOKE #9C, #1A00 [RETURN]
CSAVE "LANDER", AUTO [RETURN]

You should then be able to run the program. Should you ever need to press the reset button in the middle of a game, type:

POKE #87, 0 [RETURN]

immediately afterwards.

If you wish to make landings easier or harder then type:

POKE #16B8, X [RETURN]

where X is a number from 0 to 255. A value of 255 will make landing almost impossible and 0 will make it very easy.

If you wish to change the number of ships then change line 215 to:

POKE #59, No. of ships : POKE #BFD1, 48 + No. of ships

and type:

POKE #115E, No. of ships

the number of ships must be between 1 and 9.

Machine code dump.

```
#1000 - #40 #48 #5E #40 #61 #7F #7F #61 #73 #7F
#1009 - #7F #73 #7F #7F #7F #7F #7F #7F #7F #7F
#1011 - #40 #40 #40 #40 #40 #40 #4C #40 #49 #40
#1019 - #40 #40 #40 #40 #40 #40 #4C #40 #40 #40
#1021 - #40 #7F #7F #7F #40 #78 #7F #7F #7F #47
#1029 - #7C #7F #7F #7F #4F #7E #7F #7F #7F #5F
#1031 - #61 #62 #62 #61 #7C #4F #74 #6D #7C #6A
#1039 - #6C #4D #7E #5F #57 #7A #7F #7F #57 #7A
#1041 - #7F #7F #6A #55 #64 #49 #72 #53 #42 #50
#1049 - #47 #78 #44 #7F #7F #7F #4C #40 #5C #6B
#1051 - #6A #6A #70 #41 #7C #77 #5C #77 #5C #47
#1059 - #5C #6B #6A #6H #67 #4C #44 #41 #40 #40
#1061 - #7F #5F #40 #7F #5E #7F #7F #7F #44 #63
#1069 - #52 #71 #7F #5F #5C #7F #5E #7F #47 #4C
#1071 - #7C #7F #5E #7F #5C #47 #5C #7F #7F #7F
#1079 - #70 #41 #44 #4A #40 #54 #4C #40 #40 #46
#1081 - #40 #58 #40 #40 #40 #42 #4C #50 #40 #40
#1089 - #40 #47 #40 #78 #40 #40 #4C #40 #40 #40
#1091 - #40 #40 #40 #40 #40 #40 #40 #40 #10 #7
#1099 - #20 #48 #49 #2D #53 #43 #4F #52 #45 #20
#10A1 - #30 #30 #30 #30 #30 #20 #20 #53 #48 #49
#10A9 - #50 #53 #20 #35 #20 #20 #53 #43 #4F #52
#10B1 - #45 #20 #30 #30 #30 #30 #30 #20 #06 #18
#10B9 - #00 #00 #6 #6 #00 #51 #8 #C0 #9 #13
#10C1 - #00 #4 #00 #00 #30 #9 #00 #A #10 #00
#10C9 - #3A #12 #00 #00 #12 #00 #11 #9 #00 #2
#1104 - #20 #00 #A #26 #00 #32 #11 #00 #4 #C
#1109 - #00 #10 #00 #00 #20 #3 #1 #20 #2 #10
#1111 - #34 #B #3B #7 #1C #E #3E #1D #36 #1B
#1122 - #3C #F #18 #6 #34 #8 #2 #1C #1 #20
#1129 - #10 #7 #20 #20 #48 #5A #54 #4C #20 #53
#1131 - #50 #45 #45 #44 #20 #30 #30 #30 #20 #20
#1140 - #20 #56 #45 #52 #54 #20 #53 #50 #45 #45
#1149 - #44 #20 #30 #30 #30 #20 #20 #20 #20 #20
#1151 - #7F #7F #DF #7E #4F #7C #43 #70 #FF #A7
#1159 - #5 #B5 #59 #A9 #30 #A2 #5 #95 #65 #CA
#1161 - #D0 #FB #A2 #00 #BD #BC #10 #90 #B8 #BF
#1169 - #EB #E0 #28 #D0 #F5 #AD #5 #3 #85 #60
#1171 - #A9 #00 #85 #87 #A9 #8 #85 #76 #85 #78
#1179 - #A9 #AC #85 #77 #A9 #B6 #85 #79 #A9 #77
#1181 - #85 #70 #A9 #BE #85 #71 #A5 #70 #85 #72
#1189 - #A5 #71 #85 #73 #A2 #00 #A0 #4 #BD #00
#1191 - #10 #91 #72 #EB #BB #DC #F7 #A5 #72 #18
#1199 - #A9 #78 #85 #72 #90 #7 #FA #73 #E0 #14
#11A1 - #D0 #E6 #A5 #70 #18 #69 #4 #85 #70 #90
#11A9 - #2 #E6 #71 #A5 #70 #C9 #9F #30 #CB #A5
#11B1 - #60 #B5 #72 #A9 #BE #85 #73 #A2 #00 #A0
#11B9 - #5 #BD #14 #10 #91 #72 #EB #BB #D0 #F7
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#11D1 - #A4 #B5 #73 #A2 #00 #AC #2 #BD #3C #10
#11D9 - #91 #72 #EB #BB #D0 #F7 #A5 #72 #18 #69
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#1201 - #2 #E6 #73 #E0 #60 #D0 #E6 #A9 #3 #85
#1209 - #70 #A9 #A4 #85 #71 #A5 #80 #85 #71 #A9
#1211 - #A6 #85 #75 #A5 #60 #18 #69 #7A #85 #60
#1219 - #A9 #BE #85 #61 #A9 #0C #85 #7E #A9 #2
#1221 - #85 #2 #85 #5 #A9 #1 #E5 #64 #A5 #76
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#1249 - #2 #E6 #73 #A5 #7A #18 #69 #20 #85 #7A
#1251 - #90 #2 #E6 #7B #E0 #18 #D0 #D6 #A9 #00
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#1269 - #A0 #85 #73 #A2 #00 #AC #00 #BD #51 #11
#1271 - #91 #72 #BD #55 #11 #CE #9: #72 #C3 #C0
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#1281 - #EB #EB #E0 #B #D0 #E1 #60 #63 #A5 #00
#1289 - #C5 #1 #D0 #1D #A9 #00 #85 #00 #A5 #2
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#12B9 - #C9 #1 #D0 #6 #20 #F #15 #20 #7B #16
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#12C9 - #A5 #7C #C5 #80 #D0 #F #A9 #00 #85 #6
#12D1 - #85 #7C #EA #EA #EA #20 #E2 #17 #20 #1D
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#12F1 - #A5 #7E #C9 #1 #D0 #30 #A5 #A #C5 #B
#12F9 - #D0 #28 #A9 #00 #E5 #F #A5 #5 #C9 #00
#1301 - #D0 #9 #C6 #4 #D0 #2 #E6 #4 #18 #90
#1309 - #17 #D7 #1 #D0 #D #C6 #4 #D0 #4 #A9
#1311 - #2 #B5 #5 #18 #90 #B #A9 #00 #B5 #5
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#1321 - #F0 #3 #4C #DB #12 #A0 #63 #A5 #75 #C9
#1329 - #1 #F0 #1 #A0 #AD #B #2 #C9 #9D #30
#1331 - #7 #AD #B #2 #C9 #B6 #D0 #F9 #AD #B
#1339 - #2 #C9 #AC #D0 #3C #A2 #E2 #A0 #FF #30
#1341 - #6C #FA #A5 #2 #C5 #00 #D0 #9 #C6 #1
#1349 - #D0 #2 #E6 #1 #4C #5A #14 #C9 #1 #D0
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#1359 - #5A^#14 #A9 #00 #E5 #2 #A9 #FF #B5 #1
#1361 - #18 #90 #5F #C9 #E4 #D0 #30 #A2 #E2 #A0
#1369 - #FF #20 #6D #FA #A5 #2 #C9 #00 #D0 #5
#1371 - #E6 #1 #D0 #4 #A9 #2 #B5 #2 #18 #90
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#1381 - #1 #18 #90 #46 #A9 #1 #B5 #2 #A9 #FF
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#1409 - #85 #73 #A9 #10 #85 #65 #A0 #5 #A2 #4
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#14B9 - #72 #E9 #28 #B5 #72 #B0 #2 #C6 #73 #CA
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#14D9 - #2 #C6 #73 #A2 #10 #A0 #1 #B1 #72 #BE
#14E1 - #9: #72 #C8 #C8 #C0 #8 #D0 #F5 #A5 #72
#14E9 - #18 #69 #28 #85 #72 #90 #2 #E6 #73 #CA
#14F1 - #D0 #E5 #D6 #74 #A5 #74 #C9 #FF #D0 #2
#14F9 - #C6 #75 #A5 #74 #C9 #A0 #D0 #9 #A5 #75
#1501 - #C9 #A0 #D0 #3 #20 #B6 #17 #A5 #7E #C9
#1509 - #00 #D0 #3 #20 #C #16 #A0 #63 #A5 #76
#1511 - #C9 #00 #D0 #39 #A5 #70 #B5 #72 #A5 #71
#1519 - #B5 #73 #E6 #72 #A5 #72 #C9 #FF #D0 #2
#1521 - #C6 #73 #A2 #10 #A0 #1 #B1 #72 #BB #51
#1529 - #72 #C8 #DB #C0 #5 #D0 #F5 #A5 #72 #18
#1531 - #69 #29 #85 #72 #90 #2 #E6 #73 #CA #D0
#1539 - #E5 #C6 #70 #A5 #70 #C9 #FF #D0 #2 #C6
#1541 - #7: #A0 #8 #2 #C9 #9C #D0 #C #A9 #1
#1549 - #85 #87 #A9 #C0 #85 #2 #A9 #28 #85 #1
#1551 - #A5 #70 #38 #E9 #28 #85 #72 #A5 #71 #85
#1559 - #73 #80 #2 #C6 #73 #81 #72 #C9 #40 #F0
#1561 - #3 #20 #B6 #17 #60 #63 #A5 #87 #C9 #1E
#1569 - #F0 #3 #E5 #B7 #60 #30 #A9 #00 #E5 #1
#1571 - #85 #6D #38 #A9 #00 #E5 #4 #85 #6D #20
#1579 - #F6 #.0 #35 #70 #85 #72 #A5 #71 #85 #73
#1581 - #E6 #73 #66 #73 #18 #A5 #72 #69 #58 #85
#1589 - #72 #90 #2 #F6 #73 #A5 #72 #C5 #60 #D0
#1591 - #64 #A5 #73 #C5 #61 #D0 #5E #A5 #4 #C9
#1599 - #C6 #.0 #7 #20 #C6 #17 #FA #EA #EA #EA
#15A1 - #EA #60 #A9 #2 #85 #7E #A5 #7 #30 #E9
#15A9 - #32 #85 #7 #B0 #2 #C6 #80 #A9 #2 #85
#15B1 - #5 #B5 #2 #38 #A5 #75 #E9 #A0 #85 #6C
#15B9 - #20 #54 #18 #A9 #FF #38 #E5 #74 #85 #6A
#15C1 - #20 #6F #18 #20 #A2 #18 #A2 #1F #A0 #FE
#15C9 - #20 #6C #FA #A9 #5 #85 #72 #A2 #FF #A0
#15D1 - #FF #B0 #30 #FD #CA #D0 #FB #CA #72 #D0
#15D9 - #F2 #20 #78 #19 #20 #77 #11 #EA #EA #EA
#15E1 - #A0 #A0 #1 #B1 #70 #C9 #A0 #D0 #4 #20
#15E9 - #B6 #17 #60 #A5 #64 #C9 #1 #30 #C #A0
#15F1 - #. #B. #73 #C9 #21 #F0 #4 #20 #B6 #17
#15F9 - #A0 #85 #70 #B5 #72 #A5 #71 #B5 #73 #A5
#1601 - #72 #38 #E9 #29 #B5 #72 #B0 #2 #C6 #73
#1609 - #A0 #00 #D1 #72 #D9 #40 #D0 #35 #C0 #C0
#1611 - #4 #D0 #F5 #A2 #11 #A0 #4 #A5 #72 #18
#1619 - #A9 #28 #85 #72 #90 #2 #E6 #73 #B1 #72
#1621 - #29 #A0 #29 #A0 #D0 #19 #AD #00 #B1 #72
#1629 - #39 #41 #C9 #40 #D0 #F #CA #30 #DE #C8
#1631 - #B1 #72 #C9 #40 #D0 #5 #D0 #1 #D0 #F5
#1639 - #A0 #20 #B6 #17 #60 #63 #C6 #70 #A5 #70
#1641 - #C9 #FF #D0 #2 #C6 #71 #A2 #39 #A0 #FA
#1649 - #20 #6C #FA #A5 #70 #85 #72 #A5 #71 #B5
#1651 - #73 #A2 #00 #A0 #3 #B0 #F4 #A5 #72 #18
#1659 - #40 #91 #72 #E8 #BB #D0 #F4 #A5 #72 #18
#1661 - #A9 #20 #85 #72 #90 #2 #E6 #73 #E0 #30
#1669 - #D0 #E3 #A9 #A #E5 #72 #A2 #FF #A0 #FF
#1671 - #88 #C0 #FD #CA #D0 #FB #C6 #72 #D0 #F2
#1679 - #C6 #39 #A3 #57 #1B #67 #30 #B0 #D1 #BF
#1681 - #70 #78 #19 #20 #77 #11 #A0 #63 #A5 #76
#1689 - #85 #72 #A5 #77 #85 #73 #C6 #72 #A5 #72
#1691 - #FF #D0 #2 #E6 #73 #A2 #C #A0 #3 #B1
#1699 - #72 #38 #91 #72 #BB #BB #C0 #FF #D0 #F5
#16A1 - #18 #A5 #72 #69 #28 #85 #72 #90 #2
#16A9 - #73 #CA #D0 #E5 #E6 #78 #D0 #2 #E6 #79
#16B1 - #60 #63 #A5 #6C #C9 #00 #F0 #13 #A6 #6C
#16B9 - #E6 #67 #15 #67 #D9 #3A #D0 #6 #E6 #68
#16C1 - #A9 #30 #85 #67 #CA #D0 #EF #60 #63 #A5
#16C9 - #3A #C9 #00 #F0 #2B #A6 #6A #E6 #69 #A5
#16D1 - #69 #C9 #3A #D0 #1E #E6 #66 #A9 #30 #85
#16D9 - #59 #A5 #66 #C9 #3A #D0 #12 #E6 #67 #A9
#16E1 - #30 #85 #66 #A5 #67 #C9 #3A #D0 #6 #A9
#16E9 - #30 #85 #67 #E6 #68 #CA #D0 #D7 #60 #63
#16F1 - #A5 #59 #BD #DD #BF #A5 #66 #BD #DC #BF
#16F9 - #A5 #67 #BD #DB #BF #A5 #68 #BD #DA #BF
#1701 - #A7 #30 #05 #2D #DB #2D #A5 #2D #CD #C1
#1709 - #3F #30 #31 #D0 #1B #A5 #67 #CD #C5 #BF
#1711 - #30 #28 #D0 #12 #A5 #66 #CD #C6 #BF #30
#1719 - #1F #30 #9 #A5 #69 #CD #C7 #BF #30 #16
#1721 - #F0 #14 #A5 #68 #BD #C4 #BF #A5 #67 #BD
#1729 - #25 #BF #A5 #66 #BD #C6 #BF #A5 #69 #BD
#1731 - #C7 #BF #60 #63 #A9 #30 #BD #A1 #2 #BD
#1739 - #A0 #2 #BD #9F #2 #A5 #63 #C9 #C0 #F0
#1741 - #26 #A6 #6B #EE #A1 #2 #AD #A1 #2 #C9
#1749 - #3A #D0 #17 #A9 #30 #8D #A1 #2 #EE #A0
#1751 - #2 #A3 #A0 #2 #C9 #3A #D0 #B #A9 #3C
#1759 - #3D #A0 #2 #EE #9F #2 #CA #D0 #EC #F9
#1761 - #30 #3D #BD #BF #BD #B1 #BF #BD #B2 #BF
#1769 - #35 #6D #C9 #00 #F0 #26 #A6 #6D #EE #B2
#1771 - #3F #A0 #D2 #DF #C9 #3A #D0 #17 #A2 #30
#1779 - #3D #B2 #BF #EE #B1 #BF #AD #B1 #BF #C9
#1781 - #3A #A9 #30 #8D #31 #BF #EE #B0
#1789 - #BF #CA #D0 #DC #AD #A1 #2 #BD #A1 #BF
#1791 - #3D #A0 #2 #8D #A0 #BF #AD #9F #2 #ED
#1799 - #9F #BF #B0 #63 #A0 #00 #B9 #00 #B5 #72
#17A1 - #A9 #A0 #B5 #73 #A9 #40 #91 #72 #E6 #72
#17A9 - #D0 #2 #E6 #73 #A5 #72 #C9 #40 #D0 #F0
#17B1 - #A5 #73 #C9 #BF #D0 #EA #60 #63 #23
#17B9 - #A2 #55 #55 #55 #55 #55 #55 #55 #55 #55
```

LASER

LASER-DUEL is a two-player game for the ZX-81 where each player is in control of a V-shaped battle machine which he must use to collect gold in the playing area. If a player is shot all his gold is left where he was shot and he is sent back to his corner. The game ends when the time runs out and the winner is the player with the most gold. Controls are with the instructions printed before the game starts.

To enter the game you first need to enter a Rem 1100 characters long to hold the machine code. To enter this Rem first enter:

1 REM with 94 0's

Then using the edit alter the line number so that lines 1 to 11 are all Rems with 94 0's.

Then enter:

12 REM

When all these Rem's have been entered type:

POKE 16514,118
POKE 16515,118
POKE 16510,0
POKE 16511,78
POKE 16512,4

You have now entered the Rem. Next enter listing 1 and type Run. Type in the address where you are going to put the machine code. This will be 16514 unless you have already entered part of the hex. The address is then the first column in the hex dump. Enter each of the lines in the hexadecimal dump except for the address in the first column but include the number at the end of each line as this is a check.

If the message Error please re-enter appears type in the line again as you must have made a typing error. You do not have to enter all the machine code in one go but when you restart the hex loader remember the address will not be 16514. When all the hex has been entered save the program on tape and enter:

RAND USR 7527

This is to check that the game works. If the game fails to work check the machine code by:

RUN 1000

As an initial check you can just check the final numbers of each lines. Correct any wrong lines by entering Run and the correct address. When the machine code is working delete all of listing 1 except line 0 and enter listing 2. When all of this has been entered type Run 1000 to save and run the program.

David Ives throws down the gauntlet — it's lasers at dawn in this fight to the death on the ZX-81.

Hex dump

```
16514 17676256412813B621307  768
16524 8FFDFFFE20001002200021 102F
16534 30020FFFFFDE2A0C4036   1191
16544 176230B20368B2310FB0E  659
16554 F16ED5B31403E0FA25736  645
16564 176230B8023061E1A563F  725
16574 7B0B4300C1B0C1A0C0078C 770
16584 3043608180238002311010 218
16594 2E836B0230D20DA367623  919
16604 006203682310FB367629   695
16614 12B3E4036D0ED5B3C401A  700
16624 2FE002B05FDCB40FEC93A  1302
16634 340402134408B6F7E122A  787
16644 43C40223E40C9CDB6023A  937
16654 54040CB4520013CCB4D20  805
16664 3013DE6073240408CD30   060
16674 7203E218C4087558F4623  615
16684 64E2A3C4009221C407EFE  791
16694 9002829FE1B2B26FEB4B8  884
16704 004FE972B05FCCB40FE29  1421
16714 1FE8C20053602A444023   700
16724 222444013092A3C4087FD  785
16734 342223C48CB5ACCFDCB43  1232
16744 47ECDC4340F6603243C0   1059
16754 52B3C4322414C93A4340   710
16764 6CB7FC8218C4087558F46  1216
16774 7234E2A414036D0097EFE  727
```

DUEL

Listing 1.

```
   5 REM **ENTER PROGRAM**
  10 PRINT "ENTER ADDRESS"
  20 INPUT A
  30 INPUT A$
  40 IF A$(1)<>(STR$ A)(4) THEN
GOTO 160
  50 LET A$=A$(2 TO )
  60 LET T=0
  70 FOR B=1 TO 10
  80 LET H=16*CODE A$+CODE A$(2)
-476
  90 POKE A,H
 100 LET T=T+H
 110 LET A=A+1
 120 LET A$=A$(3 TO )
 130 NEXT B
 135 PRINT A;" ";A$
 140 IF T<>VAL A$ THEN GOTO 160
 150 GOTO 30
 160 PRINT "ERROR - PLEASE RE-EN
TER"
 170 GOTO 10
 995 REM **CHECK PROGRAM**
1000 PRINT "ENTER START ADDRESS"
1010 INPUT B
1020 FOR A=B TO 17614 STEP 10
1040 PRINT A;" ";(STR$ A)(4);
1050 LET T=0
1060 FOR B=0 TO 9
1070 LET P=PEEK (A+B)
1080 LET T=T+P
1090 PRINT CHR$ (28+INT (P/16));
CHR$ (28+P-16*INT (P/16));
1100 NEXT B
1110 PRINT " ";T
1120 NEXT A
```

Listing 2.

```
   5 CLS
  10 PRINT "
  20 PRINT "
  30 PRINT "
  40 PRINT "
  50 PRINT "
  60 PRINT " EACH PLAYER HAS A "
"V"" SHAPED   BATTLE MACHINE WHI
CH HE MUST USETO GET AS MUCH GOL
D.EACH PLAYER MUST ALSO AVIOD HI
S OPPONENT AS"
  70 PRINT "IF YOU GET SHOT THE
GOLD YOU     HAVE COLLECTED IS BL
OWN FROM YOUIN THE EXPLOSION."
  80 PRINT " KEYS ARE AS BELOW:-
"
  90 PRINT ,,"OPPERATION LEFT AN
D RIGHT PLAYER"
 100 PRINT ,,"FIRE          ""1""-"
"5""   ""6""-""0""
 110 PRINT "MOVE          ""Q""-""T
""   ""Y""-""P""
 120 PRINT "ROTATE        ""A""-""G
""   ""H""-""[illegible]""
 130 PRINT "ROTATE        ""Z""-""V
""   ""B""-""""
 140 PRINT ,,"ENTER SPEED 0(FAST
)-10(SLOW)"
 150 INPUT SPEED
 155 IF SPEED<0 OR SPEED>10 OR S
PEED<>INT SPEED THEN GOTO 150
 160 POKE 17448,250-SPEED
 170 POKE 17465,INT (50/(5+SPEED
))
 180 POKE 17540,INT (50/(5+SPEED
))
 190 RAND USR 17527
 200 FOR A=1 TO 100
 210 NEXT A
 220 CLS
 230 LET L=PEEK 15452+256*PEEK 1
5453
 240 LET R=PEEK 15462+256*PEEK 1
5463
 250 PRINT AT 10,0;"THE FINAL SC
ORE WAS :-"
 260 PRINT ,,"      LEFT PLAYER "
;L;"0"
 270 PRINT "     RIGHT PLAYER ";R
;"0"
 280 PRINT ,,,,"      WELL DONE "
;
 290 IF L>R THEN PRINT "LEFT PLA
YER"
 300 IF R>L THEN PRINT "RIGHT PL
AYER"
 310 IF L=R THEN PRINT AT 16,5;"
ITS A DRAW"
 320 FOR A=1 TO 100
 330 NEXT A
 340 RUN
1000 SAVE "LASER DUE[illegible]"
1010 RUN
9999 REM [illegible]
```

```
16704 800200C0C1D2E4140C9FD 730
16794 9CB438BFE262810FE8428 1248
16904 0.8FE122814FE812810FF 1049
16914 13B280CFE822808FE1328 656
16924 204FE072005FDCB4AFEC9 1267
16934 3FE082804FE0C2003C597 940
16944 4C9FE972803FEB4C0C600 1329
16954 5C93E9C016400B7ED4230 1066
16964 8CB7C28F83D12093EEC01 922
16974 70D0013B7ED4230CB7008 045
16984 8F83D12097DC89C131C9 1063
16994 92A0C4001070009EB2A44 430
17004 0.0CDD7412107001 9EB2A 891
17014 15040CDD7412104001 9EB 932
17024 22A4E40CDD741C92A0C40 938
17034 30118037EFEB420023697 827
17044 4FE972002C6B4230B78B1 1016
17054 520EDC9FDCB407EC82A3C 1115
17064 5403600203E403600FDCB 795
17074 740BE110101AF3253402A 637
17084 8C4407DB4284A2B224440 750
17094 93A5340A22021218A407A 759
17104 0B723231F30F846234E2A 808
17114 13C407B093D20FD7EFE80 1109
17124 220103A5340B23253402A 670
17134 3C4402322444401806FE00 617
17144 420F3368CCB22AFBA20B9 1284
17154 5/6011C3A5340FEFFE00AF 972
17164 62A0C4001230000922C40 621
17174 7223E403600C92A484036 847
17184 800ED5B4E201AFE00E805 767
17194 9FDCB4AFEC93A4A10E134 1346
17204 040856F7E422A4540E243 734
17214 140C9CDBB023A4A10CB7D 1163
17224 220013CCB7520013DE607 744
17234 332A4A0550CBBD203EE180 852
17244 44087856F45234E2A4640 802
17254 509224E407EFE00E20FE 800
17264 6.B2803FEB42804FEE720 990
17274 705FDCB4AFEC9FE8C0008 1427
17284 836002A4E4023224E4018 473
17294 9092A4E407EFD42224640 839
17304 0CB62C0FDCB407EC03A1A 1478
17314 140F6003240402A484022 839
17324 24B40C93A4D40CB7FC821 1102
17334 38C4087856F45234E2A48 883
17344 440360003FEF00D0E36 600
17354 5.B224B4009FDCB4DEEFE 1375
17364 626281CFE842818FE1228 863
17374 7:4FE81281OFE3B28CCFE 1078
17384 882808FE132804FEC720 788
17394 905FDCB40FEC9FE0C8004 1266
17304 0FE8C20033697C9FEE723 1280
17314 103FEB4C0C600C9FDCB4A 1114
17324 27EC32A4540360C2A4840 734
17334 30600FDCB4ABE110101AF 988
17344 4025340B2A4E407DD4B04A 020
17354 52B224E403A5340A2202. 851
17364 6218A407AB723231F30F8 910
17374 746234E2A46407B093D20 534
17384 8FC7EFE8020103A5340B3 1191
17394 9325340B2A4E4023224E40 592
17404 01806FE0020F3369CCB22 930
17414 1AF8A20B91601103A5340 834
17424 2FEFF20AF2A0C4001F502 1382
17434 309224E4003A484036000C0 830
17444 43A3440FEFA20F93EFF32 1326
17454 534403A52403D325240C0 759
17464 83E0A325240A5040B22 531
17474 750407CB5C0CFFF30B1AA 1578
17484 8AB9809C9C9C9C308080 1492
17494 9919C9C9C9C9C9C30B7AE 1526
17504 0ACADB9809C9C9C9C80ED 1547
17514 1BB0C4013012000314944 393
17524 DEDB0C0C0C0C40CDB0444C. 1450
17534 3C8002250403E0A325240 546
17544 43EFF324040324A40CD3D 919
17554 542CDA943CD7941CD4B43 1245
17564 6CD3042CDA943CD2A41CD 1258
17574 7EB4ADDD42CDB81CD79 1566
17584 841CD4B43CDFE41CD2342 1242
17594 9CD7941CD4B43CD2444C3 1242
17604 098441C1C1C1C1C1C1C 442
17614 11C1C1C1C1C7600D51300 282
```

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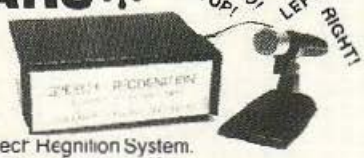

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MAP PLOTTER

John Dawson explains a BBC program to simulate plane tabling, a surveying method, to produce maps and plans.

SATELLITES, LASERS and microelectronics have made big changes to the work of surveyors and map-makers. Measurement of the rate at which glaciers flow and the movement of the Antarctic ice have been largely eliminated by serial Landsat photographs. However, for some jobs the traditional methods of the surveyor are still the best way to approach the problem. Although it is used less in this country than in North America and on the Continent, the plane table is a rugged and effective surveying instrument.

Rathbone, a 16th Century English surveyor, said that the plane table was "A most excellent and absolute instrument for this our purpose in survey." It was used extensively by the British in the Survey of India and has the advantage over other surveying methods that the plan is produced directly with no complicated recording of a multitude of angles and less chance of missing out an important detail.

A flat piece of wood

A plane table consists simply of a flat piece of wood, usually about 20 inches square, mounted on to a tripod to bring it up to a convenient height for the observer. The tripod should have an adjustable head so that the table can be levelled. A sheet of paper is clipped to the top surface of the table and an instrument called an alidade is also necessary. An alidade is simply a ruler with a straight edge and a sight at each end which can be lined up with distant objects that you wish to make on your map.

Figure 1 shows the principle of plane tabling. You must choose a baseline for your survey with an observation point at each end. If you want your map to have a defined scale, for example one inch on the map to represent 100 yards — a scale of 1 in 3600, the two points must be a known distance apart. Either you know this in advance or it can be measured using a long tape measure. Surveyors use steel link chains that are 20 or 30 metres long.

Standing at one observation point, you put the alidade on to the paper fastened to the plane table and place the edge of the ruler so that it runs through the observation point marked on the paper. The alidade is then lined up with an object that you want to record on the map; you draw a line from the observation point to the edge of the paper, and record what the bearing is to. For example, you can write "church" or "end of fence" on the margin of the paper, or simply give the bearing a number and keep a separate record in a notebook.

The first half of the process is now complete. The alidade is turned until it is in line with each of the distant objects and more lines are drawn from the observation point mark to the edge of the paper. Move the plane table to the second observation point and repeat the process for the same objects. The places where the various lines cross on the piece of paper mark the position of the objects. You can see immediately that the scale of the map is set by the length of the baseline on your piece of paper.

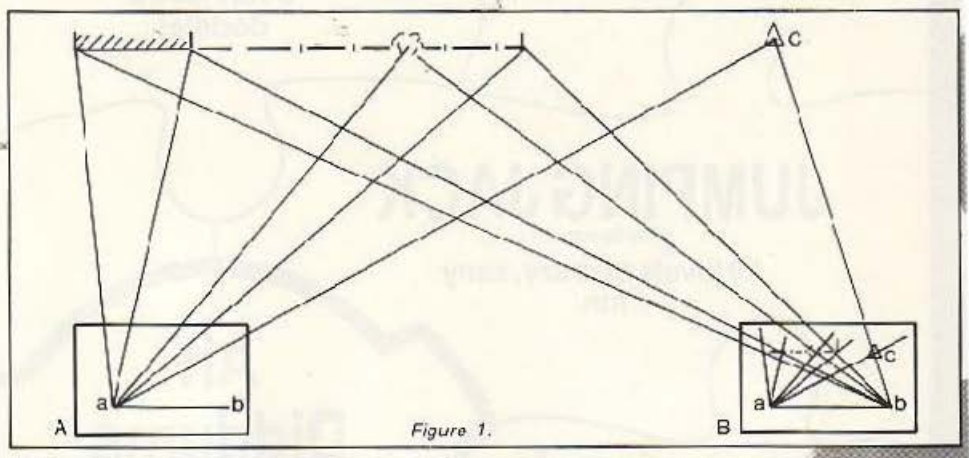


Figure 1.

If the baseline is short, the distant objects will be closer together and the scale of the map is smaller, for example 1 inch to the mile — 1 in 63360. A further observation point can be chosen and marked by angles from the two original base stations and the process can be continued using one of the original base stations and the new point. In this way the survey can be extended as far as you wish, over hills and through villages or towns.

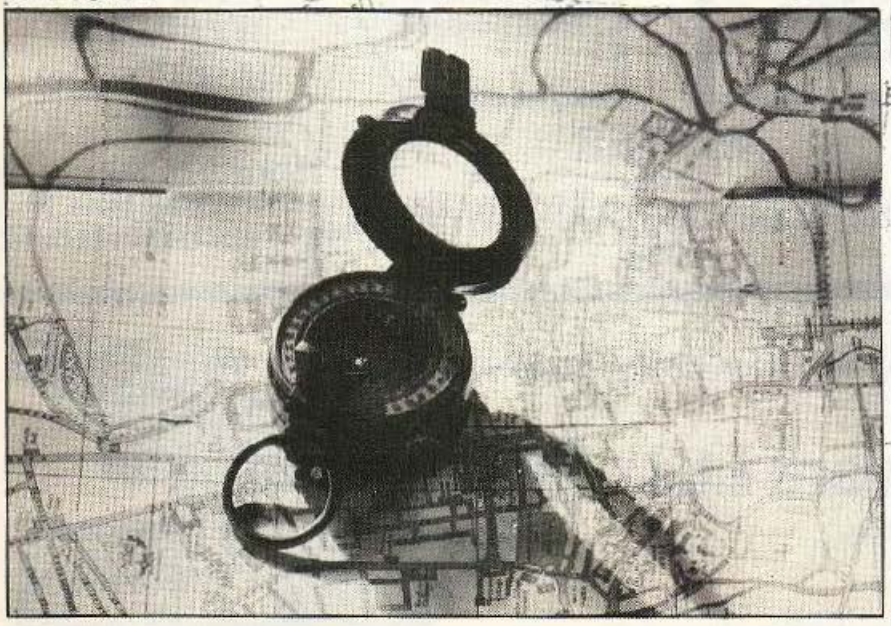
Plane tabling problems

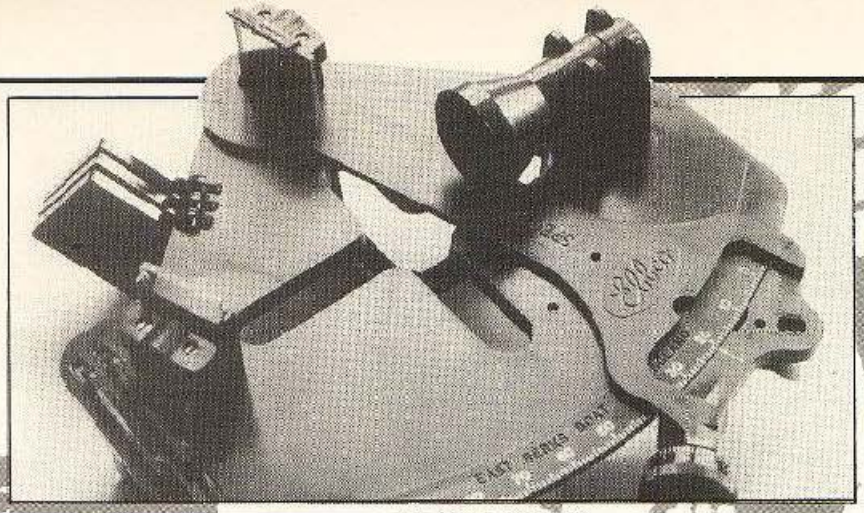
The problems with plane tabling are that the scale of the map is fixed forever once it is committed to paper and work is very difficult in a persistently wet or windy climate.

An alternative method of surveying which is used widely in the United Kingdom consists of measuring a number of distances and angles, and then constructing the plan or map in the relative comfort of the surveyor's office. Theodolites are normally used for measuring horizontal and vertical angles but the two instruments shown in figures 2 and 3 can give useful results.

If you are going to record the data from a survey rather than plotting it on to paper at the time, you will need some way of measuring the position of objects so that their positions can be modelled in your computer. Normally this is done by measuring the angle between two objects, one of which is in a known position. An alternative method which is used for quick reconnaisance sketching makes use of a prismatic compass — figure 2

Below: Figure 2.





Above: Figure 3.

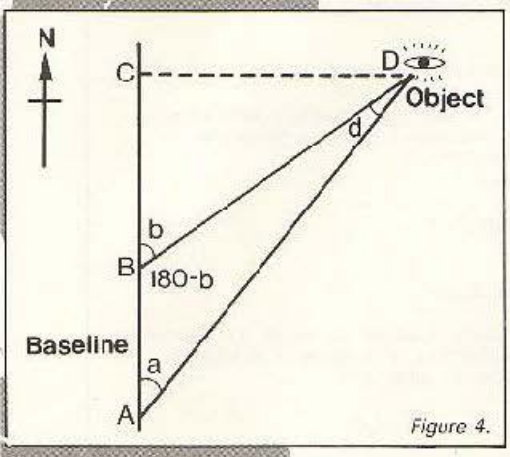


Figure 4.

— to measure the angle between the object and Magnetic North.

The prismatic compass is strongly made and can produce readings accurate to about plus or minus half a degree. The triangular prism at the rear of the compass reflects the image of the edge of the compass card just below the backsight. When the observer looks through the backsight it is possible to line up the hairline on the front glass with an object and take a reading of the bearing at the same time.

The sextant shown in figure 3 is intended for use at sea and is actually made of polycarbonate plastic. This material changes its shape less than brass when the air temperature varies. The vernier scale on the circular drum allows a user to take readings accurate to 0.2 minutes. A minute is 1/60 of a degree.

I can connect either an Epson MX80 FT or an Oric MCP 40 printer to my BBC microcomputer. Using a high resolution dump from the screen to the Epson printer or using the excellent plotting commands in the Oric printer I thought it should be possible to combine the computer with a prismatic compass or a sextant to produce maps or plans like those from a plane table. The advantage would be that they could be plotted automatically and scaled electronically.

From two observation points it is possible to find the height and distance of a far point. Figure 4 shows the simplest arrangement of angles to find the distance of a point from a line extended through the baseline. For the moment I have assumed that the baseline runs in a North/South direction. The baseline is represented by the line A-B in the figure. The formula or algorithm for finding the distance along the line running from point D to point C is:

$$D\text{-}C = \frac{A\text{-}B \sin(180\text{-}b) \cdot \sin a}{\sin d}$$

The angles inside a triangle must add up to 180 degrees so angle d can be found by adding angle a and angle 180-b together and subtracting the result from 180. I have subtracted b from 180 degrees in the formula because the bearing that you measure originally is the acute angle CBD.

The distance C-B can be found using the formula:

$$C\text{-}B = \frac{D\text{-}C}{\tan(b)}$$

When you have these two results it is an easy matter to plot the position of the object by adding the distance B-C to the baseline A-B and using that as the Y co-ordinate, with D-C as the X co-ordinate in a BBC microcomputer Move instruction.

The program consists of the following sections:

Lines 50-80 fill the two dimensional array with dummy values to stop the program having to allocate more space while it is running. OBS$ will be used to hold a series of bearings from two observation points with a short description of the object. Remember that the statement DIM OBS$(2,50) actually sets aside memory for an array three items wide and 51 items deep as both dimensions start from zero in BBC Basic.

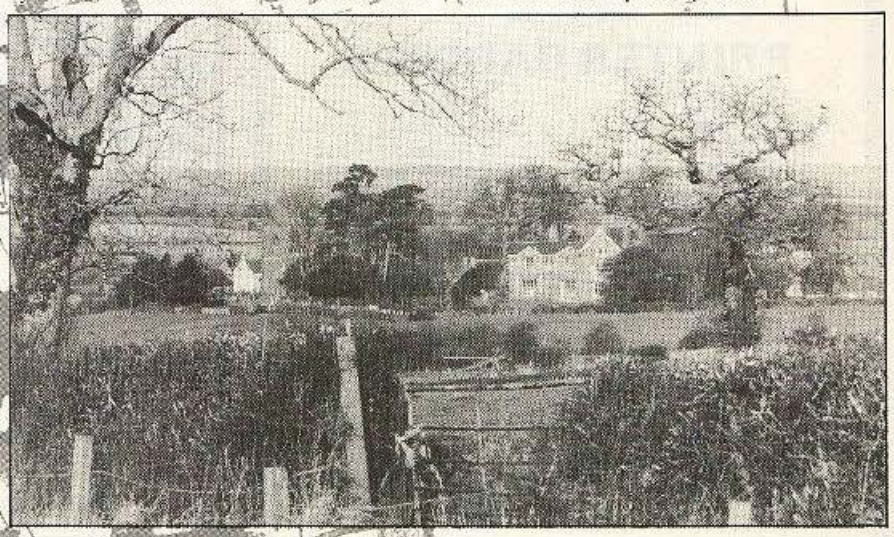
Establishes text window

Line 170 establishes a text window in the bottom three lines of the screen and line 180 sets the graphics origin to the left hand edge of the screen and just above the text window. The largest vertical or Y value that can be displayed on the screen is now 1024-200.

Lines 730-850 are the definition of the initialisation procedure. The Repeat...Until loop continues until you have entered the co-ordinates for all the observation points. The purpose of line 790 is to prevent a line being drawn from somewhere off the screen to the first base. After you have entered the first base, the subsequent bases are linked by lines 800 and 810.

Line 300 sets a flag to a known state at the start of the loop before the character typed in by the user is checked and acted upon. PROCangle, lines 390-490, either draws a new bearing on the screen, or clears an existing bearing depending on the state of the flag. PROCclear, lines 950-980, sets the flag to the opposite state and then calls PROCangle to unplot a bearing by plotting it again in the current background colour, line 450.

I will show how the output from the program can be plotted next month using the Oric four colour plotter/printer.



```
10 REM MAP PLOTTING PROGRAM .
20 REM STARTED 29 JANUARY 1984
30
40 DIM OBS$(2,50): DIM BASE(1,10)
50 FOR Z = 0 TO 2
60   FOR ZZ = 0 TO 50
70     OBS$(Z,ZZ) = "*******"
80     NEXT ZZ: NEXT Z
90
100 X = 0: Y = 0: XOR = 0: YOR = 0: D = 1200: BASE
```

```
ANGLE = 0
110 BASEN0% = 1: BASEE% = 2: B$ = ","
120
130 MODE 6
140 *KEY 9 "MODE 7 IM IN LIST IM"
150 *KEY 0 "RUN IM"
160
170 VDU 28,0,31,79,28
180 VDU 2*,0,200;
```

(listing continued on next page)

(listing continued from previous page)

```
150
200 PROCinitialise
210
220 REPEAT
230   CLS
240   PRINT "Current base: ";BASENO%;" at ";BASE(0
,BASENO%);,;BASE(1,BASENO%)
250   PRINT "Input <A>ngle <B>ase change <P>rint s
creen <C>lear bearing";
260
270   REPEAT
280     K$ = INKEY$(100)
290     UNTIL K$ <> ""
300   CF = FALSE
310   IF K$ = "A" THEN PROCangle
320   IF K$ = "C" THEN PROCclear
330   IF K$ = "B" THEN PROCbasechange
340   IF K$ = "P" THEN PROCprint
350   UNTIL K$ = "Q"
360 END
370
380
390 DEF PROCangle
400 CLS
410 INPUT "Input angle of bearing: "A
420 X = D*COS(RAD(A))
430 Y = D*SIN(RAD(A))
440 IF CF = FALSE THEN 470 ELSE 450
450 PLOT 3,X,Y
460 GOTO 480
470 PLOT 1,X,Y
480 PLOT 4,XOR,YOR
490 ENDPROC
500
510 DEF PROCorn
520 CLS
530 PRINT "Input X and Y coordinates for base numb
er ";BASENO%,
540 INPUT "X: "X
550 INPUT "Y: "Y
560 PROCcross (X,Y)
570 ENDPROC
580
590 DEF PROCcross (X,Y)
600 B$ = STR$(BASENO%)
610 XOR = X: YOR = Y
620 MOVE XOR-8,YOR
630 DRAW XOR+8,YOR
640 MOVE XOR,YOR+8
650 DRAW XOR,YOR-8
660 MOVE XOR-40,YOR+50
670 VDU 5
680 PRINT B$
690 VDU 4
700 MOVE XOR,YOR
710 ENDPROC
720
730 DEF PROCinitialise
740 CLS
750 INPUT "How many bases ?" BASES%
760 REPEAT
770   PROCorn
780   BASE(0,BASENO%) = X: BASE(1,BASENO%) = Y
790     IF BASENO% = 1 THEN 820
800   MOVE BASE(0,BASENO% -1),BASE(1,BASENO% 1)
810   DRAW BASE(0,BASENO%),BASE(1,BASENO%)
820   BASENO% = BASENO%+1
830   BASES% = BASES%-1
840   UNTIL BASES% = 0
850 BASENO% = BASENO%-1
860 ENDPROC
870
880 DEF PROCbasechange
890 CLS
900 INPUT "Input base number to move to "BASENO%
910 X = BASE(0,BASENO%): Y = BASE(1,BASENO%)
920 MOVE X,Y: XOR = X: YOR = Y
930 ENDPROC
940
950 DEF PROCclear
960 CF = TRUE
970 PROCangle
980 ENDPROC
```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Program A.

```
   3 GO TO 10
   4 CLS : CLEAR : PAUSE 20: PRI
NT "Press Y to continue
    Any other key to abandon"
   5 POKE 23658,0
   6 IF INKEY$="" THEN GO TO 6
   7 IF INKEY$<>"y" THEN GO TO 8
000
  10 LET rp=30000
  11 IF rp<30000 THEN PRINT "RP
must be larger than 29999"
  20 INPUT "NUMBER OF PROGRAMS 1
-9 ? ";n
  21 IF n<1 OR n>9 THEN GO TO 20
  22 LET rtop=PEEK PEEK 23732+25
6*PEEK 23733-21*8: LET b=rtop-rp
  29 DIM a(n)
  30 FOR f=1 TO n
  40 PRINT AT 19,0;"BYTES LEFT="
;b;"      "
  50 PRINT AT 20,0;"PROGRAM ";f
  51 RANDOMIZE USR 3582
  55 INPUT "Number of Bytes assi
gned to      program ";(f);" ? ";
y
  60 IF y<200 THEN PRINT £0;"TOO
FEw BYTES !": PAUSE 50: GO TO 5
5
  70 LET b=b-y: IF b-(n-f)*200<0
 THEN PRINT £0;"Not enough room
for rest of      programs !": PAU
SE 50: LET b=b+y: GO TO 55
  75 PRINT AT 19,0;y;" bytes": R
ANDOMIZE USR 3582: RANDOMIZE USR
 3582
  80 LET a(f)=y: NEXT f
  85 LET tot=30000
  86 LET p=29000
  90 FOR f=1 TO n
 100 LET p=p+12
 101 POKE p+1,INT (tot/256): POK
E p,256*(tot/256-PEEK (p+1))
 110 LET tot=tot+a(f)
 120 NEXT f
 125 LET p=p+12: POKE p+1,INT (r
top/256): POKE p,256*(rtop/256-P
EEK (p+1))
 130 POKE 29154,n
 140 RANDOMIZE USR 29152
8000 INPUT "Prog ? 0-";(PEEK 291
54);" ";a: POKE 23729,a
8010 RANDOMIZE USR 29643: BEEP 0
.2,0: GO TO 8000
9998 SAVE "Prog" LINE 9999: STOP

9999 CLEAR 28999: LOAD ""CODE :
RUN
```

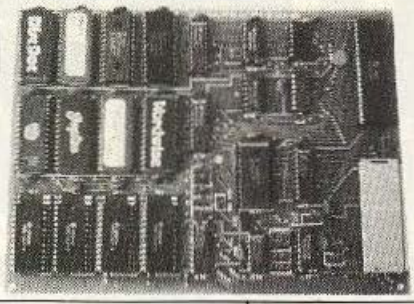
WHEN CLIVE SINCLAIR brought out the 1K ZX-81, his first customers found great limitations in its use. The unexpanded ZX-81 had limited memory, crude graphics and a most strange display system, which varied in size. Yet a whole host of impressive software developed for this computer, pushing it to its limits and further. Sinclair's next computer, the Spectrum, had a far more impressive specification but was still lacking in comparison say, to the BBC.

However, programmers have occasionally managed to produce excellent games for the Spectrum showing up even the games-oriented machines such as the Atari. Admittedly, the Spectrum will never quite be in the class of these other more expensive machines but at least by using clever techniques, one can push it toward their level. I hope this routine takes the Spectrum one step nearer.

This routine is written to allow the

(continued on page 105)

SIR ROM MODEL 2



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Program B.

```
   5 CLEAR 29148
  10 DATA "c32473f30609c578cd327
25e235623e521af15011500edb0e11bc
d2a72132cd2a72cd2a723e801213cd2a7
23e0d12133e801223235e23562b2b2b1
bcd2a72c110c5af32b05c3e06ed47ed5
efbc973237223c93ab05ccb27174717 8
016005f21487119c9cd"
  11 DATA 13291
  20 DATA "2f72dd214f5ccd6e72dd2
1575ccd6e72dd21535ccd6e72dd214b5
ccd6e72dd21595ccd6e72dd21b25ccd6
e72c9fdcb4746280b5e235623cd7300d
d7201c9dd5e0cdd560173237223c9cd4
072d5ebed5b3d5cafed52223d5c2a4f5
ce53ab15c32b05cfdcb"
  21 DATA 14526
  30 DATA "47c6cd4072d12a515cafe
d52ed5b4f5c1922515c2ab25ced5b3d5
cafed52223d5cd1cd0f73210000226c5
c220b5ccdb0162a3d5c7efe032810232
3ed5bb25c1b1b1b732372fdcb47d63a2
b74feff280332445c3eff322b742a615
c2b22555c210c00226e"
  31 DATA 13910
  40 DATA "5caf32705cc9626bafed7
2444d0303e3ed5bb25cedb81313ebf9c
9fff3f5c5d5e5dce5fd36470001fe7fe
d781f38751f3872112c743e03cda1743
ae271c630cdbc743a3b5cf5fdcb01dea
f32085ccdbf02f1323b5cfdcb01ae3a0
85cfe50281bfe702817"
  41 DATA 14624
  50 DATA "fe61cad47421e271d6303
8d24604b830cd21b05cbe200e3ab05cf
53e02112c74cda174181232b15cf5cdc
b731f38113e01112c74cda174f1c630c
dbc74cdbe73fdcb475e2008dde1e1d1c
1f1fbc7fbc7f0c06012100fa2b7cb520f
b10f6c921e271fd3647"
  51 DATA 14100
  60 DATA "003ab15c4604b83818f37
e32b15c112c74afcda174f1c630cdbc7
43e01323a5cc932b15ca718092104002
2425c322b74cd8a723ab15ca7201ffdc
b475628153eeccd810f3e34cd810f3e0
d32085cfdcb01ee1804fdcb47deafc9f
fff2020202020202020"
  61 DATA 13765
  70 DATA "202020202020204e4f205
3554348205052 4f472eff20202020202
0202020202020202020202020204f2e4b2
02050726f672eff2020202020202020202
0202020202020437572726e7420507
26f672eff41314e45572d2d503d45534
34150452d2d2d2d5052"
  71 DATA 11448
  80 DATA "4f472e3f203020ff21014
022d07421201822d274cd410c1ae67fc
dbc74131a8730f5c9d52ad074ed4bd27
4cd240b22d074ed43d274d1c91e40031
82ab25c363e2bf92b2b223d5c2a4f5cf
bc33812ed56c9ed5ec9"
  81 DATA 11580
5000 LET c=0: LET f=29149
5010 FOR h=1 TO 8: READ a$
5020 FOR s=1 TO LEN a$ STEP 2
5030 LET a=CODE a$(s): LET b=COD
E a$(s+1)
5040 LET c=c+b+a
5050 IF a>96 THEN LET a=a-39
5060 IF b>96 THEN LET b=b-39
5070 LET a=a-48
5080 LET b=b-48
5090 POKE f,a*16+b
5100 LET f=f+1
5110 NEXT s
5111 PRINT h
5120 READ tot: IF tot<>c THEN PR
INT "Error at line ";h*10: STOP
5125 LET c=0
5130 NEXT h
5131 IF f<>29933 THEN PRINT "wro
ng number of data bytes": STOP
5200 SAVE "code"CODE 29149,800
```

(continued from page 103)

Spectrum programmer the benefit of having up to 10 Basic programs stored in the computer at any one time — a facility normally found only on more expensive machines. Each program is directly accessible by two simple key strokes. Also, jumps to particular lines in different programs can be made from any Basic program. For example you might jump from line 200 of program 4 to line 50 of program 6. Thus program 1 might be used as a menu, calling up games or utilities stored in programs 2-9.

The program is easily stored in the computers: Type in program A and save using line 9998 then type in program B. When this runs error free save the code, after program A on the tape.

When loaded, program A will auto-run picking up the code from program B. You will then be asked how many programs you want 1-9. Having selected a number you will then step through each program deciding how many bytes to allocate. A minimum is 200, the maximum number of bytes is determined by the memory you have free. Once a fixed amount of memory is allocated to each program, it is not possible to change this without deleting all the programs.

Finally you will be asked which program you wish to initially select. Having selected a program, program A will "disappear" leaving you with a blank Basic program ready for your programming. Program A can be recalled at any time by selecting program 0.

If program 0 is selected using keys it will autostart at line 4. If you are sure you will not need to reassign memory to the programs. Incidentally, this has the effect of Newing all the programs other than program 0 at one go. You can New program 0. There is little point though since you have nine other program stores at your disposal.

The multiprogram routine uses the interrupts to check the keys pressed. To change the program you are currently handling simply press Capshift and Break/Space.

You will then be given the following message:

A = NEW P = ESCAPE----- WHICH PROG? X

where X is the number of programs you are handling. Pressing P will bring you back to your current program. Key A will New the current program.

Do not use the Sinclair New command as this may crash the computer. Otherwise selecting a number will exchange your current program with the program selected. All the program variables, current data read position and Microdrive channels of the old program will be saved. It is therefore very easy to hop between programs.

Switching programs

The other way to switch programs is from within a program itself. Use the following method to do this:

Routine C

```
9000 POKE 23619, NT
     (L/256) : POKE 23618,
     INT (256* L/256 —
     PEEK 23619)
9010 POKE 29739,S
9020 POKE 23729,P
9030 RAND USR 29643
```

where L = line number to jump to; S = statement number — normally C and P = program.

Thus for a menu routine which calls three different programs you might use the following method:

```
10 PRINT "GAME 1"
20 PRINT "GAME 2"
30 PRINT "GAME 3"
40 INPUT "WHICH GAME 1-3 ?" : P
50 LET S = 0 : L = 0
60 GO TO 9000 Routine C)
```

For those of you who program in machine code it is still possible to have a RAMtop area free for code. Do this by altering the variable RTOP in line 22 of program A.

Different programs occur at different places in memory so the first byte of a line 1 Rem statement is not necessarily 23760.

When using the printer you will need to turn the interrupt routine off. Do this by typing:

RAND USR 29927

Turn it on again by typing:

RAND USR 29930

You can jump between programs with the interrupt routine turned off using Routine C.

The following is a list of subroutines used by the machine code-routine:

Address	Function
29149	Interrupt vector sends interrupt routine here. JP to 29475.
29152	Initialisation routine
29226	Number store routine for above
29231	Calculates address of system variable storage area for each program
29248	Routine to either retrieve or store necessary system variables
29322	Main routine to swop system variables
29455	Routine to move machine stack below new program RAMtop
29475	Interrupt routine — Reads keyboard + check for Capshift, Space/Break — Waits for P, A or number — Calls different routines depending on what is entered
29630	Delay loop
29643	Main routine which calls swop routine 29322 and checks for errors. (If the program number is too high an error message will be given)
29857	Print a string routine
29883	Print a character routine
29927	Int. routine off
29930	Int. routine on

For tape copies of the program please send £2.30 and a stamp addressed envelope to Mark Jones, 17 Park Walk, London SW10 0AS. Please state that you require Multiprogram. ■

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- The decision of the editor is final.
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SNAPMAN

David Rees gets to grips with the grizzly ghosts.

AFTER SEEING A version of the Pac-Man game in action, I decided to write a version for the Commodore 64, and this is the result.

Graphics are very extensive. There are two different mazes produced from user-defined graphics, containing pills and power pills, each worth 10 points. Also, at random intervals, fruit appears beneath the ghosts' lair, and can either be a cherry — 100 points, strawberry — 500 points, or the Commodore logo — 1000 points. There are four multi-colour ghosts with mobile eyes and edible bodies, and one Snapman.

Movement of the Snapman is controlled by a joystick — port one — or the keyboard. Ghosts have the logic for angry, fearful, random or homeward motion, and move at half speed after you eat a power pill. They flash white when they are about to return to normal. They can also hide beneath one another to confuse you.

The Snapman scenario

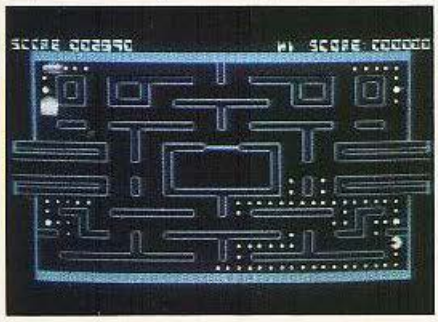
If the details above have persuaded you that the game is worthwhile, here is its scenario: You are a little hungry Snapman, lost in the food maze. To keep going you must eat the pills and fruit of the maze, while at the same time avoiding the angry ghost monsters, whose touch means death. However, you do have a weapon against them. They become edible when they turn blue after you have eaten a large power pill — ghost scores are 1st: 200; 2nd: 400; 3rd: 800; 4th: 1600. After all the pills in one maze have been eaten, you escape to a new and faster maze. This continues until all your three lives are lost.

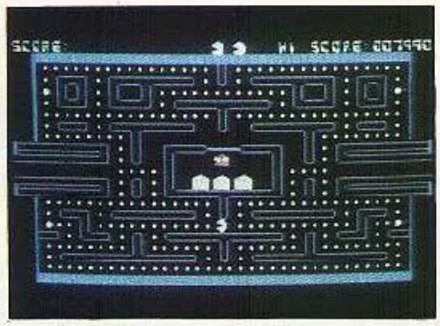
Snapman comes in two parts, a Basic section to handle registers, the maze and scoring, and a code section which stores graphics and the main game. The code is loaded as a set of hexadecimal numbers.

To help with entering the code, I have included a third program. If you Run it, you can start at any point along the code and enter the numbers. After you have finished, use

RUN 700

This will display totals of numbers in the sections of memory, and the correct totals. If these do not agree, there is an incorrect





number in that section of memory. You can then use

RUN 900

This gives a screen listing from any point along the code, in the same format as the magazine listing, and you can use it to find the mistake.

After the mistake has been found, you can use the first input routine to correct it. Finally, when you think that all the code is correct, you can save it directly after the Snapman Basic program on the tape by using

RUN 1100

It is best to save the code after the Basic, because the program loads the code shortly after you have Run it.

If there is still something wrong with the code after it has been saved, use the Basic Snapman program to Load the code, stop the Basic, Load the input program, and carry on as if you had found a mistake as above.

My highest score on the standard game is 224640. However, if you want to make it harder — or easier — for yourself, it is fairly easy to change the format of the game for your own use.

L gives the number of lives that you have left. Although only a maximum of two lives are displayed on the screen, L can be any number in the floating point range. Also, in Line 540, the Stop and Restore keys are disabled, to stop anyone from ruining the game just when you are reaching a record score. If you want to be able to stop the game, simply change the number at the end of the line to 255.

TD is another important variable, controlling the speed of the main program, with a normal value of 2048. However, if the start speed is too fast all you have to do is increase TD, and for a more challenging game, simply reduce TD. For the fastest game possible, TD should equal zero, where the speed will be 500 moves per second. Also, if you want the speed to increase at a different rate, simply change the number 100 in line 5110.

Loading graphics into RAM

SC controls the type of maze used, so if you want to use only the big maze or the small maze, keep SC constant by changing line 5120. By varying this line, mazes can appear in any order, and by changing lines 860-900, provision can be made for more mazes to be added in the gap between 2000 and 4899.

Care does have to be taken with one section of the program, lines 45 to 95. This loads normal graphics into RAM. To do this, Input/Output memory has to be switched out of main memory. This means that functions, like key input, must be switched off, so if there is an error in this section of program, there is no way to restart the computer, except by switching it off and then on.

Finally, if the program seems too long to type in, and you would prefer to receive it on a C15 cassette, send your name, address, and £3 to: David Rees, The Georgian House, Brooks Close, Weybridge, Surrey KT13 0LX.

Hex loader.

```
: REM*****************
2 REM*HEX CODE INPUT*
3 REM*   PROGRAM    *
4 REM*  INCLUDING   *
5 REM* ROUTINES FOR *
6 REM*CHECKS +SAVING*
7 REM*      BY      *
8 REM*  DAVID REES  *
9 REM*****************
:0 REM*ENTER NUMBERS*
:1 GOSU3500
:5 POKE52,55:POKE56,55:GOTO200
20 B=0:K=14*1024:J=20591
30 INPUT"START POSITION",A$
40 IFLEN(A$)<>4THEN30
50 FORN=1TO4
60 B$=MID$(A$,N,1)
70 FORM=0TO15
80 IFB$=A$(M)THENJ10
90 NEXTM
:00 GOTO40
:10 B=B+(2↑(4*(4-N)))*M
120 NEXTN
130 IFBKKORBOJTHEN20
140 RETURN
200 GOSUB22
210 GOSUB630:PRINTB$.
220 GOSUB550:IFN=16THEN220
230 C=N*16:PRINTA$;
240 GOSUB550:IFN=16THEN240
250 POKEB,J+N B=B+1:PRINTA$
340 IFBCJ+1THEN210
350 ENI
500 DIMA$(15)
510 FORN=0TO9 A$(N)=RIGHT$(STR$(N),1) NEXT
520 FORN=10TO15:A$(N)=CHR$(N+55):NEXT
530 RETURN
550 GETA$:IFA$=""THEN550
560 FORN=0TO15:IFA$=A$(N)THENRETURN
570 NEXT
580 N=16:RETURN
600 C=BAND15:D=(BAND240)/16
610 E=(BAND3840)/256:F=(BAND28672)/4096
620 B$=A$(F)+A$(E)+A$(D)+A$(C)
630 RETURN
699 REM*CHECKSUMS*
700 M$(0)="3800":M(0)=14336:M$(1)="3B00"
710 M(1)=15104:M$(2)="4000":M(2)=16384
720 M$(3)="4400":M(3)=17408:M$(4)="4800"
730 M(4)=19432:M$(5)="4B00":M(5)=19200
740 M$(6)="5000":M(6)=20480:M$(7)="50D3"
750 M(7)=20691
760 T(0)=67588:T(1)=83622
770 T(2)=107791:T(3)=114244
780 T(4)=99513:T(5)=135890
790 T(6)=22370
800 FORN=0TO6
810 T=0:A=M(N):B=M(N+1)
820 FORM=ATOB:T=T+PEEK(M) NEXT
830 PRINTM$(N)" TO "M$(N+1)
840 PRINT" CORRECT="T(N),"ACTUALLY="T
850 NEXTN
899 REM*PEEK CHECK*
900 GOSUB500:GOSUB20
910 B=BAND32768
920 GOSUB600
930 FORM=0TO7
940 F=PEEK(B+M):G=BAND15:R=(BAND240)/16
```

(Hex loader continued on page 111)

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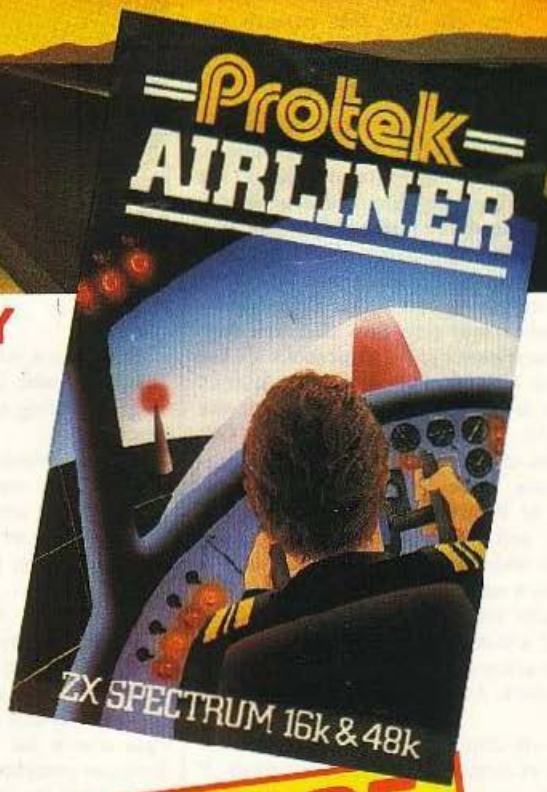

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(Hex loader continued from page 109)

```
950 B$=E$+" "+A$(R)+A$(Q)
960 NEXTM
970 PRINTB$:B=3+8
980 IFB>J+8THENEND
990 GETF$:IFA$=""THEN990
1000 GOTO920
1099 REM*SAVE*
1100 FORN=0TO35
1110 READA:POKE40704+N,A
1120 NEXTN
1130 SYS40704
1200 DATA169,56,133,252,169,81,133,254
1210 DATA169,,133,251,133,253
1220 DATA162,1,160,255,32,186,255
1230 DATA169,0,32,189,255,169,251
1240 DATA166,253,164,254,32,216,255,96
```

Basic program.

```
5 H$="000002"
10 V=53248:DIMS(99)
20 POKEV+32,0:POKEV+33,0
30 PRINT"SNAPMAN"
40 PRINTCHR$(142)
45 POKE56334,PEEK(56334)AND254
50 POKE1,PEEK(1)AND251
55 FORI=0TO511:POKEI+12288,PEEK(I+53248):NEXTI
60 FORI=0TO4:READA:FORN=0TO15
65 POKE12576+I*16+N,PEEK(53248+A*8+N/2)
70 NEXTN,I
75 FORI=0TO1:READA:FORN=0TO7
80 POKE12656+I*8+N,PEEK(53248+A*8+N)
85 NEXTN,I
90 DATA19,14,1,16,13,95,105
95 POKE1,PEEK(1)OR4:POKE56334,PEEK(56334)OR1
100 POKEV+21,0
110 POKE51,0:POKE52,44
120 POKE55,0:POKE56,44
130 FORN=0TO19
140 READA:POKE39936+N,A
150 NEXTN
160 DATA162,1,160,255,32,186,255
170 DATA169,,32,189,255,169,255,169,255
180 DATA32,213,255,96
185 FORN=0TO52:READS(N):NEXT
190 FORN=0TO5:READB(N):NEXTN
200 PRINT"LOADING DATA"
210 SYS39936
220 POKE14659,24:POKE14659,60:POKE14660,60:POKE14661,24
250 POKEV+24,29:POKEV+35,6:POKEV+17,PEEK(V+17)OR64:POKEV+36,2
251 PRINT"":POKE56022,255
252 PRINTTAB(13)"# & ( , ( & "
253 PRINTTAB(13)" | F + F | "
255 PRINT""TAB(14)"BY DAVID REES"
257 PRINT"DO YOU REQUIRE JOYSTICK OR KEYBOARD USE"
258 LF$="A/C/C":J=2:LL=0
259 SC=0:TD=2048
260 INPUTA$:IFA$="J"THENPOKE913,1:GOTO297
270 IFA$<>"K"THENPRINT"INPUT 'K' OR 'J' PLEASE":GOTO260
280 PRINT"KEYS:":POKE913,0:POKE54276,0
290 PRINT"LEFT : Z  RIGHT : X"
295 PRINT"UP   : F5 DOWN : F7"
297 PRINT"PRESS ANY KEY TO CONTINUE"
298 GETA$:IFA$=""THEN298
310 F=0:L=2:HS=0
350 POKEV+24,31
360 FORN=0TO11:POKE743+24+N,0:NEXT
370 S=54272:POKES+24,15
380 POKES+14,255:POKES+15,255
390 POKES+18,129
500 POKE875,0:POKE876,0
510 POKE877,0:POKE878,0
520 POKE859,0:POKE860,2
530 POKE861,2:POKE862,2
540 POKE863,2:POKE59322,127
550 POKE896,2
560 POKE931,0:POKE932,16
570 POKE917,0:POKE916,0:POKE918,0
580 POKEV+39,7
590 FORN=0TO3:POKEV+40+N,N+2:NEXT
600 POKE2040,247:POKE2041,242
610 POKE2042,242:POKE2043,242
620 POKE2044,242
630 POKEV+23,30
640 POKEV+37,0:POKEV+38,1
650 FORN=0TO3:POKEN+929,5:NEXT
660 POKE935,0
670 POKEV+15,0
750 POKE917,0
760 POKE941,0
800 POKE96+256*79,68
810 POKE97+256*79,79
820 POKE113+79*256,254
830 POKE20556,144
850 POKE94+56*256,24
860 IFLL=0THEN900
870 IF(SC AND 1)=1THEN1800
880 GOTO1300
900 IF(SC AND 1)=1THEN1500
1000 PRINT"##&"          -1 ##X"          ";
1020 PRINT"  DACCCCACACCCACCCACCCCCCCCCCCCCCE"
1030 PRINT"  GMOOOOOOOOOOOOOOOOMNMOOOOOOOOOOOOOOOOOH"
1040 PRINT"  GMOFJKLMOFJIKJIIITMOOPMOOSIIIKJIKLMOFJKLMOGH"
1050 PRINT"  GKCMNMOOMN MNMOOOOOOOOOOOOMN.MNMOOMNMKCH"
1060 PRINT"  GMOOPQRMOOPIQRMOOSIIIKJIIITMOOPIQRMOOPQRMOGH"
1070 PRINT"  GMOOOOOOOOOOOOOOOOMNMOOOOOOOOOOOOOOOOOH"
1080 PRINT"  GMOOCIITMOOSIKJIIIIT OT CIIIIKJITMOOCIITMOGH"
1090 PRINT"  GMOOOOOOOMN                  MNMOOOOOOOH"
1100 PRINT"UIIIIIIIKLMOOMN FJIIMWXYIIKL MNMOFJIIIIIIIIZ";
1110 PRINT"VIIIIIIIORMOOOR MN           MN ORMOOPIIIIIIIC";
1120 PRINT"            MOOOOMN           MNMOOOO"
1130 PRINT"EIIIIIIIKLMOOFLMOOMN           MNMOOFLMOOFJIIIIIIII";
1140 PRINT"UIIIIIIIORMOOORMOOPIIIKJIIIORMOOSMOOPIIIIIIZ";
1150 PRINT"  GMOOOOOOOOOOOOOOOOMNMOOOOOOOOOOOOOOOOOH"
1160 PRINT"  GMOOSIKLMOOSIIIIIITMOORMOOSIIIIIIITMOFJITMOGH"
1170 PRINT"  GKCMOOMNMOOOOOOOOOOO  OOOOOOOOOOOOMNMOOKCH"
1180 PRINT"  UITMOOPITMOOFLMOOSIIIIKJIIIITMOOFLMOOSIORMOOSIZ"
1190 PRINT"  GMOOOOOOOOMNMOOOOOOMNMOOOOOOOMNMOOOOOOOOH"
1200 PRINT"  GMOOCIIIIIQICIIIITMOOMOOCIIIQICIIIITMOOH"
1210 PRINT"  GMOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOH"
1220 PRINT"  +++++++++++++++++++++++++++++++++++"
1300 POKE907,14:POKE908,1
1310 POKE914,147:POKE915,5
1320 POKE927,121:POKE928,146
1330 POKE929,140:POKE930,206
1340 POKE926,113
1350 POKEV,177:POKEV+1,177
1360 POKEV+2,175:POKEV+3,129
1365 POKEV+4,159:POKEV+5,145
1370 POKEV+6,175:POKEV+7,145
1375 POKEV+8,191:POKEV+9,145
1390 GOTO4900
1500 PRINT"##&":          -1 ##X"          ";
1520 PRINT"DAAAAAAAAAAAAAAAAABCAAAAAAAAAAAAAAAAAE";
1530 PRINT"GMOOOOOOOOOOOOOOOOOOMNMOOOOOOOOOOOOOOOOOOOH";
1540 PRINT"GMOOFJKLMOOFJKLMOOFJIKLMOOMNMOOFJIIKLMOOFJKLMOOFJKLMOGH";
1550 PRINT"GKCMNMNMOOMNMNMOOOPIIORMOOMOOPIIORMOOMNMNMOOMNMNKCH";
1560 PRINT"GMOOMNMNMOOMNMNMOOOOOOOOOOOOOOOOMNMNMOOMNMNMOGH";
1570 PRINT"GMOOOPQRMOOOPQPIITMOOSIIKJIIITMOOSIIQPQRMOOOPQRMOGH";
1580 PRINT"GMOOOOOOOOOOOOOOOOOOMNMOOOOOOOOOOOOOOOOOOOH";
1590 PRINT"GMOOSIITMOOSIIKJIIIIIT OR SIIIIKJIITMOOSIITMOGH";
1600 PRINT"GMOOOOOOOOOMN                MNMOOOOOOOOOH";
1610 PRINT"VIIIIIIKLMOOMN FJIIIWXYMIIKL MNMOFJIIIIIIZ";
1620 PRINT"VIIIIIIORMOOOR MN            MN ORMOOPIIIIIIC";
1630 PRINT"           MOOOOMN             MNMOOOO        "
1640 PRINT"EIIIIIIKLMOOFLMOOMN           MNMOOFLMOOFJIIIIIII";
1650 PRINT"UIIIIIIORMOOORMOOPIIIKJIIIORMOOORMOOPIIIIIIZ";
1660 PRINT"GMOOOOOOOOOOOOOOOOOOMNMOOOOOOOOOOOOOOOOOOOOH";
1670 PRINT"GMOOSIKLMOOSIIIIIIITMOORMOOSIIIIIIITMOOSIITMOGH";
1680 PRINT"GMOOOMNMOOOOOOOOOOOO  OOOOOOOOOOOOMNMOOOH";
1690 PRINT"UITMOOPITMOOFLMOOSIIIKJIIIITMOOFLMOOSIORMOOSIZ";
1700 PRINT"GMOOOOOOOOOOMNMOOOOOOMNMOOOOOOOMNMOOOOOOOOOH";
1710 PRINT"GMOOFJIIIIIQPIITMOOFLMOOMNMOOFLMOOSIIQPIIIIKLMOGH";
1720 PRINT"GKCMNMOOOOOOOOOOMNMOOMNMOOMNMOOOOOOOOOOOMNKCH";
1730 PRINT"GMOOCORMOOSIIIIIIIIIORMOOORMOOPIIIIIIIIITMOOORMOGH";
1740 PRINT"GMOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOH";
1750 PRINT"+++++++++++++++++++++++++++++++++++++++"
1760 POKE2023,30:POKE56295,6
1800 POKE907,92:POKE908,1
1810 POKE914,187:POKE915,6
1820 POKE927,129:POKE928,154
1830 POKE929,139:POKE930,214
1840 POKE926,121
1850 POKEV,177:POKEV+1,185
1860 POKEV+2,175:POKEV+3,137
1865 POKEV+4,159:POKEV+5,153
1870 POKEV+6,175:POKEV+7,153
1875 POKEV+8,191:POKEV+9,153
4900 PRINT""TAB(34)HS"TAB(19)LF$
4910 POKEV+21,31:POKEV+17,PEEK(V+17)AND191
4920 IFLL=0THENPOKE875,0:POKE876,0
4950 IFSC=0ANDL=2THENGOSUB10000
5000 TH=INT(TD/256):POKE992,TH:POKE991,TD-256*TH
5001 POKEV+21,31:LL=0
5002 K=PEEK(30+V):POKE54283,0
5010 SYS20416
5030 X=PEEK(798)
5040 IFX=128THEN5100
5050 IFX=255THEN5200
5060 END
5070 GOTO5010
5100 FORN=7LTO7STEP-0.2:POKEV+35,N:NEXTN
5110 TD=TD-100:IFTD<1THENTD=1
5120 SC=SC+1
5180 PRINT"":POKEV+21,0:POKE54296,0
5190 GOTO510
5200 L=L-1:IFL=0THENLF$="  ":GOTO5220
5210 LF$="A/C"
5220 S=54272:POKES+24,15:LL=1
5230 POKES+5,63:POKES+6,129:N=70
5240 POKES,0:POKES+1,N:POKES+4,17
5250 FORT=0TO30:NEXTT
5260 POKES+4,0
5270 N=N/1.09:IFN>10THEN5240
5390 POKES+15,0
5400 IFL=-1THENPOKE54296,0:GOTO6000
5410 GOTO510
6000 S$="":FORN=0TO5
6010 X=PEEK(1030+N):S$=S$+CHR$(X)
6020 NEXTN
6025 POKE54296,0
6030 S=VAL(S$):PRINT"":POKEV+21,0
6040 FORN=0TO9
6050 IFS>A(N)THEN6080
6060 NEXTN
6070 GOTO7000
6080 FORM=9TONSTEP-1
6090 A$(M+1)=A$(M):A(M+1)=A(M)
6100 NEXTM
6110 A(N)=S:NN=N
6120 PRINT"":POKEV+24,29:POKEV+17,PEEK(V+17)OR64
6130 POKEV+34,7:POKEV+15,2:POKEV+36,0
6140 X=17:PRINTTAB(X)"#& ( , ( &"
6150 PRINTTAB(X)"% ) - - ) "" X=11
6155 PRINT"   PLEASE ENTER YOUR NAME AND PRESS"
6157 PRINTTAB(17)"L--"
6160 PRINT""TAB(X)"                 "
6170 PRINTTAB(X)"                   "
6180 PRINTTAB(X)"A,                 /"
6190 C=0
6195 FORN=0TO15:GETA$:NEXTN
6200 SYS15159
6210 A=PEEK(2):IFA=20THEN6300
6220 IFA=13THEN6500
6230 IFA<32ORA>95THEN6200
6240 IFA<48ANDA>35THEN6200
6250 IFA>63THENA=A-64
6260 POKE1396+C,A-64:C=(C+1)AND15
6270 GOTO6200
6300 C=(C-1)AND15:POKE1396+C,96:GOTO6200
6500 A$="":FORN=0TO15
6510 X=PEEK(1396+N)-64:IFX<32THENX=X+64
6520 A$=A$+CHR$(X)
6530 NEXTN
6540 A$(NN)=A$:GOTO7000
7000 PRINT"":X=14
7010 POKEV+24,29
7020 POKEV+17,PEEK(V+17)OR64
7030 POKEV+34,5:POKEV+35,6
7040 PRINTTAB(X)"# & ( #   ( &"
7050 PRINTTAB(X)"% ) ) + - ) ("
7060 PRINTTAB(X)"# S C O R E S"
7070 FORN=0TO9
7080 PRINT""N+1"."A$(N):PRINT"",,""A(N)""
7090 NEXTN
7100 PRINT"       "
7110 GETA$
7120 X=PEEK(V+35):IFX=246THENPOKEV+35,2:GOTO7140
7130 POKEV+35,6
7140 IFA$<>CHR$(13)THENFORN=0TO299:NEXTN:GOTO7110
7150 PRINT"";
7160 POKEV+17,PEEK(V+17)AND191
7170 H$=STR$(A(0))
7180 L=LEN(H$):H$=RIGHT$(H$,L-1)
7190 A$="":IFL-1=6THEN7240
7200 FORN=L-1TO5
7210 A$=A$+"0"
7220 NEXT
7230 H$=A$+H$:PRINT""
7240 GOTO250
8000 DATA50,,4,50,50,13,50,50,12,50
8010 DATA70,,4,50,70,13,50,70,12,50,,100
8020 DATA50,,6,50,50,15,50,50,14,50
8030 DATA70,,6,50,70,15,50,70,14,50,,100
8040 DATA50,,4,50,50,13,50,50,12,50
8050 DATA70,,4,50,70,13,50,70,12,50,,100
8060 DATA,14,,15,,16
10000 S=54272:POKES+24,15
10010 POKES+5,9:POKES+6,0
10020 FORN=0TO59STEP3
10030 POKES,S(N):POKES+1,S(N+1):POKES+4,33
10040 FORT=0TOS(N+2):NEXTT
10050 POKES+4,0:NEXTN
10060 FORN=0TO5STEP2
10070 POKES+4,33
10080 FORI=0TO15
10090 POKES,B(N)+I*2:POKES+1,B(N+1)
10100 NEXTI
10110 POKES+4,0:FORT=0TO69:NEXTT,N
10120 RETURN
```

Hex code dump.

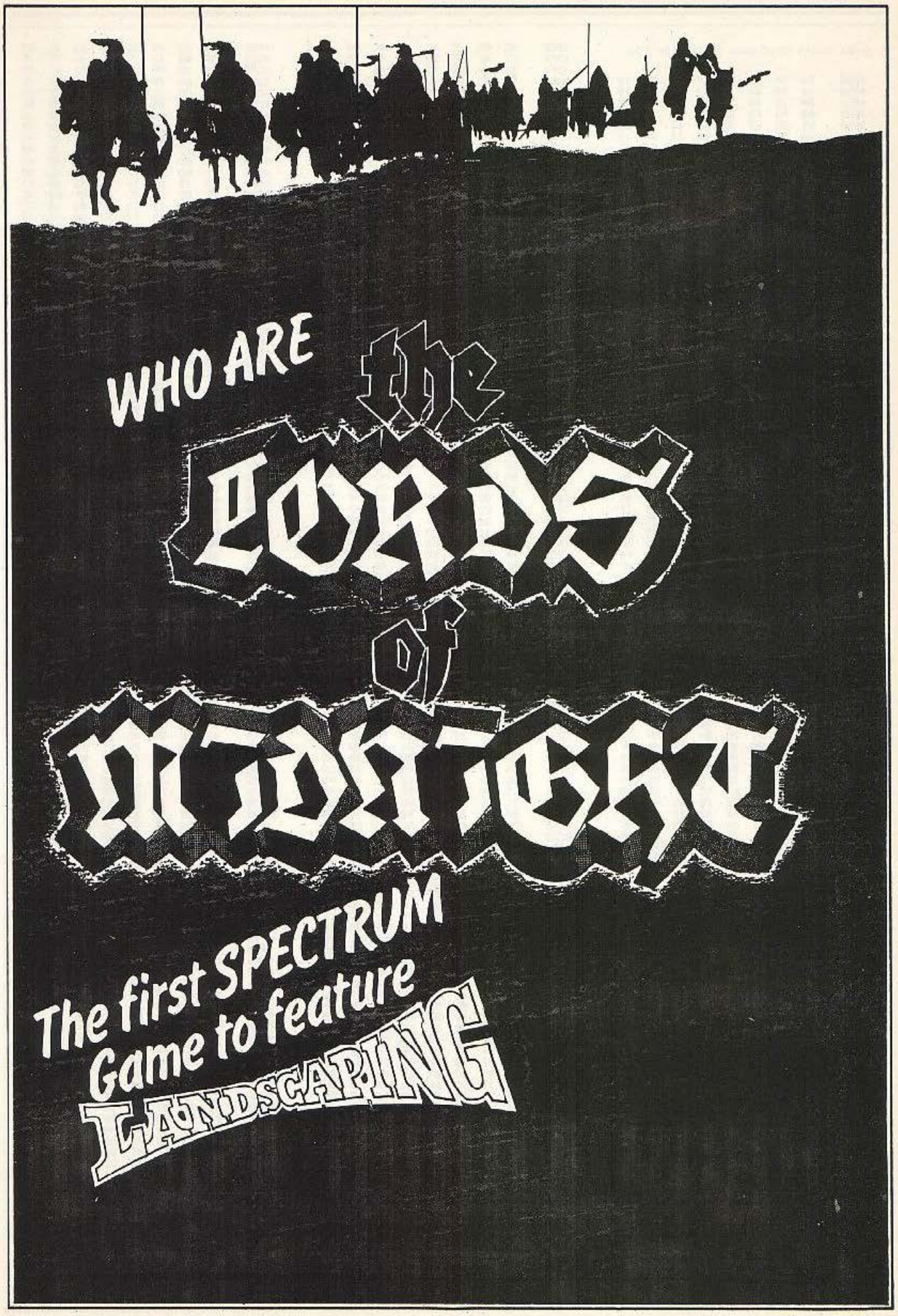
```
3300    00  00  00  18  18  00  00  00
3308    FF  FF  FF  FF  FF  FF  FF  00
3310    FF  FF  FF  FF  FF  FF  FF  0C
3318    FF  FF  FF  FF  FF  FF  FF  30
3320    FF  FF  FF  FF  FF  FF  FF  F0
3328    FF  FF  FF  FF  FF  FF  FF  0F
3330    00  07  0C  0C  0C  0C  0C  0C
3338    F0  F0  F0  F0  F0  F0  F0  F0
3340    0F  0F  0F  0F  0F  0F  0F  0F
3348    00  FF  00  00  00  00  FF  00
3350    00  FF  00  00  00  00  0F  30
3358    00  FF  00  00  00  00  F0  0C
3360    00  E0  30  30  30  30  30  30
3368    0C  0C  0C  0C  0C  0C  0C  0C
3370    30  30  30  30  30  30  30  30
3378    0C  0C  0C  0C  0C  0C  07  00
3380    30  0F  00  00  00  00  FF  00
3388    0C  F0  00  00  00  00  FF  00
3390    30  30  30  30  30  30  E0  00
3398    00  07  0C  0C  0C  0C  07  00
33A0    00  E0  30  30  30  30  E0  00
33A8    F0  FF  F0  F0  F0  F0  FF  F0
33B0    F0  FF  80  80  80  80  FF  00
33B8    00  E0  30  1F  1F  30  E0  00
33C0    00  00  00  FF  FF  00  00  00
33C8    00  07  0C  F8  F8  0C  07  00
33D0    0F  FF  0F  0F  0F  0F  FF  0F
33D8    0F  FF  01  01  01  01  FF  00
33E0    00  FF  80  80  80  80  FF  F0
33E8    00  FF  01  01  01  01  FF  0F
33F0    F0  FF  FF  FF  FF  FF  FF  FF
33F8    00  FF  FF  FF  FF  FF  FF  FF
3900    00  00  00  00  00  00  00  00
3908    0F  FF  FF  FF  FF  FF  FF  FF
3910    00  00  00  00  00  00  00  00
3918    3E  20  20  3E  03  03  3F  00
3920    3E  20  20  20  30  30  3E  00
3928    3E  22  22  22  32  32  3E  00
3930    3E  22  22  3C  24  32  32  00
3938    3E  20  20  3E  30  30  3E  00
3940    00  00  13  3C  3C  18  00  00
3948    00  01  02  02  0C  1E  1A  0C
3950    40  80  80  40  30  78  68  30
3958    01  07  0F  0F  07  07  03  01
3960    80  E0  53  30  E0  60  C0  80
3968    03  0F  1C  18  18  1C  0F  03
3970    00  00  E0  C0  C0  E0  00  00
3978    00  00  00  00  00  00  00  00
3980    7E  42  42  62  62  52  7E  00
3988    10  10  10  18  18  18  18  00
3990    7E  02  02  7E  60  50  7E  00
3998    7E  02  02  7E  06  36  7E  00
39A0    48  48  48  7E  18  18  18  00
39A8    7E  40  40  7E  06  36  7E  00
39B0    40  40  40  7E  62  52  7E  00
39B8    7E  02  02  02  06  36  06  00
39C0    7E  42  42  7E  46  46  7E  00
39C8    7E  42  42  7E  06  36  06  00
39D0    00  00  10  00  00  10  00  00
39D8    1C  7F  FF  1F  07  1F  FF  7E
39E0    00  00  00  00  00  30  00  00
39E8    F5  F6  F7  F6  F5  F8  F9  F8
39F0    F5  FA  FB  FA  F5  FC  FD  FC
39F8    F7  F7  F7  F7  00  30  7F  7F
3A00    22  22  22  3E  32  32  32  00
3A08    7F  7F  00  00  7F  7F  00  00
3A10    FF  FF  00  00  FF  FF  00  00
3A18    7F  7F  00  00  7F  7F  00  00
3A20    FF  FF  00  00  FF  FF  00  00
3A28    7F  7F  00  00  7F  7F  00  00
3A30    FF  FF  00  00  FF  FF  00  00
3A38    7F  7F  00  00  7F  7F  00  00
3A40    CD  A8  03  F0  06  8D  A9  03
3A48    18  90  27  8D  FB  03  C9  00
3A50    F0  06  29  02  C9  00  D0  0D
3A58    AD  9C  03  18  69  02  18  8D
3A60    A9  A3  18  90  F6  AD  9A  03
3A68    8D  A9  03  49  01  18  8D  AC
3A70    03  60  C9  00  F0  06  29  02
3A78    C9  00  D0  0D  FD  9C  03  18
3A80    69  02  18  8D  FB  03  18  90
3A88    06  AD  9A  03  ED  AB  03  49
3A90    01  18  8D  AC  03  60  00  00
3A98    7F  7F  00  00  7F  7F  00  00
3AA0    FF  FF  00  00  FF  FF  00  00
3AA8    7F  7F  00  00  7F  7F  00  00
3AB0    FF  FF  00  00  FF  FF  00  00
3AB8    7F  7F  00  00  7F  7F  00  00
3AC0    8D  A9  03  49  01  18  8D  AD
3AC8    03  C9  00  F0  06  29  02  C9
3AD0    00  D0  0D  AD  9C  03  18  69
3AD8    02  18  8D  AA  03  18  90  06
3AE0    AD  9A  03  8D  AA  03  CD  A8
3AE8    03  F0  01  60  8D  AB  03  A4
3AF0    02  B9  5C  03  8D  A9  03  AD
3AF8    AB  03  49  01  18  8D  AC  03
3B00    A9  FF  60  FF  00  00  FF  FF
3B08    80  80  FF  FF  80  80  FF  FF
3B10    00  00  FF  FF  00  00  FF  FF
3B18    80  80  FF  FF  80  80  FF  FF
3B20    00  00  FF  FF  00  00  FF  FF
3B28    80  80  FF  FF  80  80  FF  FF
3B30    00  00  FF  FF  00  00  FF  FF
3B38    80  80  FF  FF  80  80  FF  FF
3B40    A9  FF  8D  02  DC  20  9F  FF
3B48    20  E4  FF  85  02  A9  7F  8D
3B50    02  DC  60  FF  00  00  FF  FF
3B58    80  80  FF  FF  80  80  FF  FF
3B60    00  00  FF  FF  00  00  FF  FF
3B68    80  80  FF  FF  80  80  FF  FF
3B70    00  00  FF  FF  00  00  FF  FF
3B78    80  80  FF  FF  80  80  FF  FF
3B80    00  00  FF  FF  00  00  FF  FF
3B88    80  80  FF  FF  80  80  FF  FF
3B90    00  00  FF  FF  00  00  FF  FF
3B98    80  80  FF  FF  80  80  FF  FF
3BA0    00  00  FF  FF  00  00  FF  FF
3BA8    80  80  FF  FF  80  80  FF  FF
3BB0    00  00  FF  FF  00  00  FF  FF
3BB8    80  80  FF  FF  80  80  FF  FF
3BC0    00  00  FF  FF  00  00  FF  FF
3BC8    A5  80  FF  FF  80  80  FF  FF
3BD0    00  00  FF  FF  00  00  FF  FF
3BD8    80  80  FF  FF  80  80  FF  FF
3BE0    00  00  FF  FF  00  00  FF  FF
3BE8    80  80  FF  FF  80  80  FF  FF
3BF0    00  00  FF  FF  00  00  FF  FF
3BF8    80  80  FF  FF  80  80  FF  FF
3C00    0A  80  00  2A  A0  00  AA  A8
3C08    00  BE  F8  00  9E  78  00  AA
3C10    A8  00  AA  A8  00  AA  A8  00
3C18    AA  A8  00  88  8E  00  00  00
3C20    00  00  00  00  00  00  00  00
3C28    00  00  00  00  00  00  00  00
3C30    00  00  00  00  00  00  00  00
3C38    00  00  00  00  00  00  00  00
3C40    0A  80  00  2A  A0  00  AA  A8
```

(Hex dump continued on next page)

(Hex dump continued from previous page)

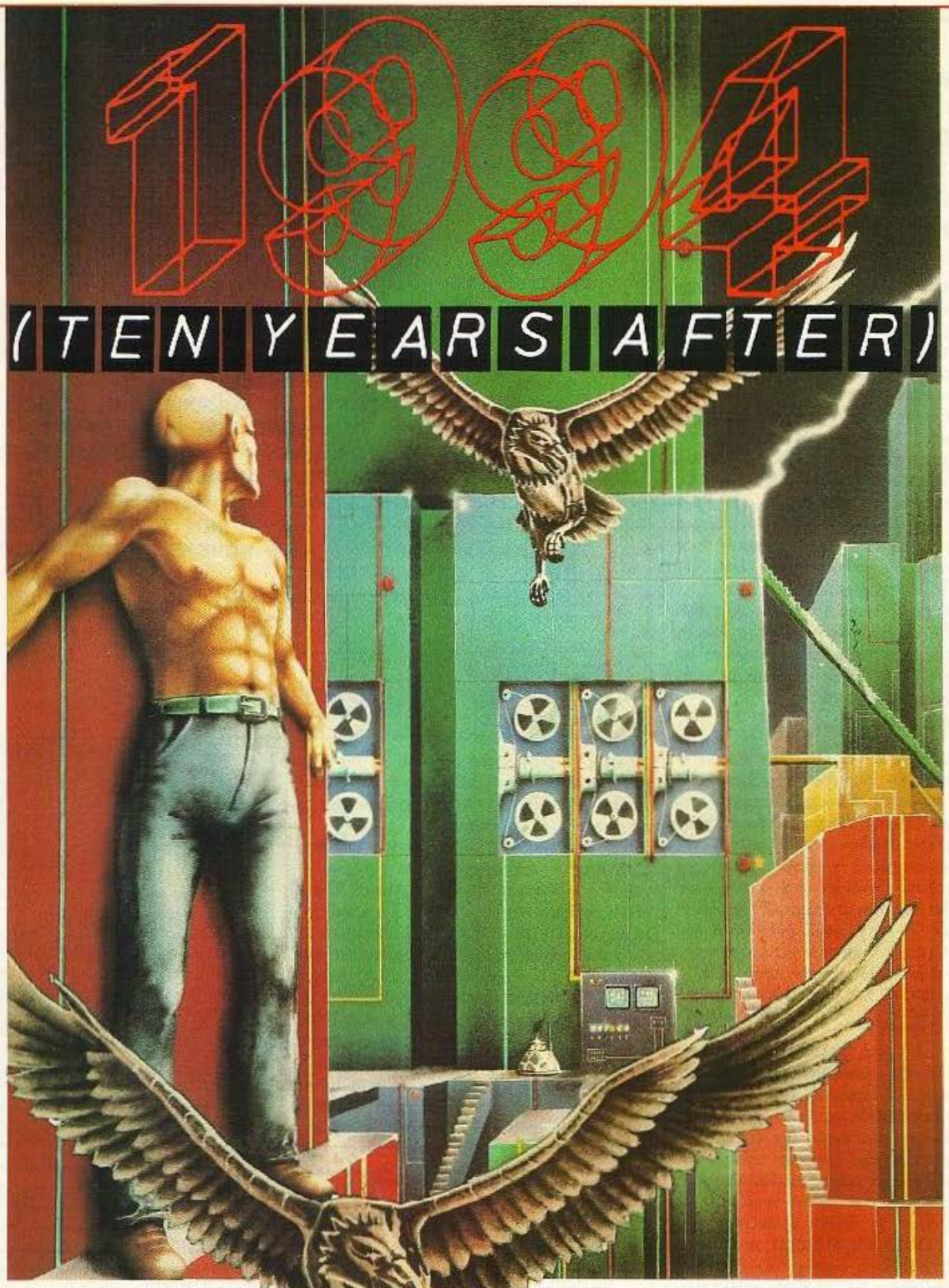
```
3C48  00 BE F8 00 B6 D8 00 AA
3C50  A8 00 A9 A8 00 AF A8 00
3C58  AA A8 03 88 88 00 00 00
3C60  00 00 03 00 00 00 00 00
3C68  00 00 03 00 00 00 00 00
3C70  00 00 03 00 00 00 00 00
3C78  00 00 03 00 00 00 00 00
3C80  0A 80 03 2A A0 00 AA A8
3C88  00 B6 F8 00 BE F8 00 AA
3C90  A8 00 A9 A8 00 AF A8 00
3C98  AA A8 03 88 88 00 00 00
3CA0  00 00 03 00 00 00 00 00
3CA8  00 00 03 00 00 00 00 00
3CB0  00 00 03 00 00 00 00 00
3CB8  00 00 03 00 00 00 00 00
3CC0  0A 80 00 2A A0 00 AA A8
3CC8  00 BE F8 00 B6 F8 00 AA
3CD0  A8 00 AA A8 00 AF A8 00
3CD8  AA A8 00 88 88 00 00 00
3CE0  00 00 00 00 00 00 00 00
3CE8  00 00 00 00 00 00 00 00
3CF0  00 00 00 00 00 00 00 00
3CF8  00 00 00 00 00 00 00 00
3D00  0A 80 00 2A A0 00 AA A0
3D08  00 BA B8 00 BA B8 00 AA
3D10  A8 00 AE E8 00 BB B8 00
3D18  AA A8 00 88 88 00 00 00
3D20  00 00 00 00 00 00 00 00
3D28  00 00 00 00 00 00 00 00
3D30  00 00 00 00 00 00 00 00
3D38  00 00 00 00 00 00 00 00
3D40  1C 00 00 7F 00 00 7F 00
3D48  00 FF 80 00 FF 80 00 FF
3D50  80 00 7F 00 00 7F 00 00
3D58  1C 00 00 00 00 00 00 00
3D60  00 00 00 00 00 00 00 00
3D68  00 00 00 00 00 00 00 00
3D70  00 00 00 00 00 00 00 00
3D78  00 00 00 00 00 00 00 00
3D80  1C 00 00 7F 00 00 7F 00
3D88  00 FF 80 00 1F 80 00 FF
3D90  80 00 7F 00 00 7F 00 00
3D98  1C 00 00 00 00 00 00 00
3DA0  00 00 00 00 00 00 00 00
3DA8  00 00 00 00 00 00 00 00
3DB0  00 00 00 00 00 00 00 00
3DB8  00 00 00 00 00 00 00 00
3DC0  1C 00 00 7F 00 00 FF 00
3DC8  30 1F 80 00 07 80 00 1F
3DD0  B0 00 FF 00 00 7F 00 00
3DD8  1C 00 00 00 00 00 00 00
3DE0  30 00 00 00 00 00 00 00
3DE8  30 00 00 00 00 00 00 00
3DF0  30 00 00 00 00 00 00 00
3DF8  30 00 00 00 00 00 00 00
3E00  1C 00 00 7F 00 00 7F 00
3E08  30 FF 80 00 FC 00 00 FF
3E10  B0 00 7F 00 00 7F 00 00
3E18  1C 00 00 00 00 00 00 00
3E20  30 00 00 00 00 00 00 00
3E28  30 00 00 00 00 00 00 00
3E30  00 0A A0 00 00 00 00 00
3E38  00 00 00 00 00 00 00 00
3E40  1C 00 00 7F 00 00 7F 00
3E48  00 FC 00 00 F0 00 00 FC
3E50  00 00 7F 00 30 7F 00 C0
3E58  1C 00 00 00 30 00 00 00
3E60  00 00 00 00 30 00 00 00
3E68  00 00 00 00 30 00 00 00
3E70  00 00 00 00 30 00 00 00
3E78  00 00 00 00 30 00 00 00
3E80  14 00 00 77 30 00 77 00
3E88  80 FF 80 00 FF 80 00 FF
3E90  80 00 7F 00 00 7F 00 00
3E98  1C 00 00 00 30 00 00 00
3EA0  00 00 00 00 30 00 00 00
3EA8  00 00 00 00 30 00 00 00
3EB0  00 00 00 00 30 00 00 00
3EB8  00 00 00 00 30 00 00 00
3EC0  22 00 00 63 00 00 63 00
3EC8  00 F7 80 03 F7 80 00 FF
3ED0  80 00 7F 03 00 7F 00 00
3ED8  1C 00 00 03 00 00 00 00
3EE0  00 00 00 03 00 00 00 00
3EE8  00 AA AA 03 00 00 00 00
3EF0  00 00 00 03 00 00 00 00
3EF8  00 00 00 00 00 00 00 00
3F00  1C 00 00 7F 00 00 7F 00
3F08  00 FF 80 03 FF 80 00 FF
3F10  80 00 77 00 00 77 00 00
3F18  14 00 00 00 00 00 00 00
3F20  00 00 00 00 00 00 00 03
3F28  00 00 00 00 00 00 00 03
3F30  00 00 00 00 00 00 00 03
3F38  00 00 00 00 00 00 00 03
3F40  1C 00 00 7F 00 00 7F 03
3F48  00 FF 80 00 F7 80 00 F7
3F50  80 00 63 00 00 63 00 03
3F58  22 00 00 00 00 00 00 03
3F60  00 00 00 00 00 00 00 03
3F68  00 00 00 00 00 00 00 03
3F70  00 00 00 00 00 00 00 03
3F78  00 00 00 00 00 00 00 00
3F80  00 08 FF FF 0A 0A FF FF
3F88  08 08 7F 7F 08 08 7F 7F
3F90  08 08 FF FF 08 08 FF FF
3F98  08 08 7F 7F 08 08 7F 7F
3FA0  0A 0A FF FF 08 08 FF FF
3FA8  08 03 7F 7F 0E 08 7F 7F
3FB0  08 03 FF FF 0E 08 FF FF
3FB8  08 03 7F 7F 0E 08 7F 7F
3FC0  08 03 FF FF 0E 08 FF FF
3FC8  6D 08 7F 7F 0E 08 7F 7F
3FD0  08 03 FF FF 0E 08 FF FF
3FD8  08 08 7F 7F 06 03 7F 7F
3FE0  06 06 FF FF 02 03 FF FF
3FE8  08 08 7F 7F 06 03 7F 7F
3FF0  08 08 FF FF 08 03 FF FF
3FF8  08 08 7F 7F 08 03 7F 7F
4000  A0 05 B9 50 03 13 79 4A
4008  03 18 99 50 03 33 E9 0A
4010  90 0E 18 99 50 03 39 4F
4018  03 18 69 01 18 99 4F 03
4020  88 C0 FF D0 DD A0 80 B9
4028  50 03 18 69 30 13 99 06
4030  04 A9 00 99 4A 03 C8 C0
4038  A6 D0 EC 60 FF FF 80 80
4040  8C B9 03 B9 5B 03 C9 00
4048  D0 0A 8D 85 03 A9 82 8D
4050  86 03 A9 00 C9 01 D0 0A
4058  A9 02 8D 0C 03 A9 0D 8D
4060  85 03 C9 02 D0 0A A9 05
4068  8D 85 03 A9 00 8D 86 03
4070  C9 03 D0 1B C0 00 D0 0D
4078  A9 05 8D 85 03 A9 0A 8D
4080  86 03 18 90 0A A9 05 8D
4088  85 03 A9 0B 8D 86 03 98
4090  AA A9 01 EA E0 00 F0 08
4098  8A 18 EA EA EA CA D0 F8
40A0  8D 88 03 AD 10 D0 2D 88
40A8  03 18 C9 00 F0 02 A9 01
40B0  8D 88 03 8C 89 03 98 0A
40B8  A8 AD 88 03 C9 00 D0 16
40C0  B9 00 D0 38 E9 1C 18 6D
40C8  85 03 18 4A 18 4A 18 4A
40D0  18 85 FB 18 90 2A B9 00
40D8  D0 38 E9 1C B0 0E 18 6D
40E0  85 03 90 14 18 4A 18 69
40E8  80 18 90 0D 18 6D 85 03
40F0  18 4A 18 69 00 10 90 01
40F8  4A 18 4A 18 4A 18 85 FB
4100  B9 01 D0 38 E9 33 18 6D
4108  86 03 18 4A 18 4A 18 4A
4110  10 05 FE A9 04 85 FC A0
4118  00 C4 FE F0 12 A5 FB 18
4120  69 28 50 03 18 E6 FC C8
4128  C4 FE EA D0 F2 85 FB A0
4130  00 B1 FB 29 00 F0 2E C9
4138  28 F0 2A 29 29 F0 26 C9
4140  2A F0 22 29 2B F0 1E C9
4148  2C F0 1A 29 2D F0 16 C9
4150  2E F0 12 29 20 F0 0E AC
4158  89 03 C0 30 D0 0A A9 00
4160  60 EA EA EA EA A9 01 60
4168  C9 1E D0 0E B9 5B 03 C9
4170  02 F0 F2 B9 8C 03 C9 04
4178  F0 E8 A9 30 60 00 7F 7F
4180  C0 02 D0 09 E0 00 D0 01
4188  60 CA D0 FD 60 CA D0 FD
4190  88 D0 FA 60 00 00 FF FF
4198  00 00 7F 7F 00 00 7F 7F
41A0  00 00 FF FF 00 00 FF FF
41A8  00 00 7F 7F 00 00 7F 7F
41B0  00 00 FF FF 00 00 FF FF
41B8  00 00 7F 7F 00 00 7F 7F
41C0  A9 39 85 FC AD 5E 03 0A
41C8  18 0A 18 A8 EE 8F 03 4D
41D0  8A 03 C9 10 D0 05 A9 30
41D8  8D 8A 03 18 4A 18 4A 18
41E0  69 E8 90 03 18 E6 FC 35
41E8  FB B1 FB 6D FB 07 60 7F
41F0  00 00 FF FF 00 00 FF FF
41F8  00 00 7F 7F 00 00 7F 7F
4200  FF FF 00 00 FF FF 00 30
4208  7F 7F 00 00 7F 7F 00 30
4210  FF FF 00 00 FF FF 00 30
4218  7F 7F 00 00 7F 7F 00 30
4220  FF FF 00 00 FF FF 00 30
4228  7F 7F 00 00 7F 7F 00 30
4230  FF FF 00 00 FF FF 00 30
4238  7F 7F 00 00 7F 7F 00 30
4240  AD 94 03 C9 01 F0 01 60
4248  A9 00 8D 94 03 A9 01 8D
4250  49 03 A9 01 85 FD A0 00
4258  B9 28 D0 C9 F0 F0 18 A9
4260  06 99 20 D0 D9 F4 99 F9
4268  07 AD 1B D4 25 01 C9 00
4270  F0 05 A9 02 99 8D 03 06
4278  FD 18 C8 C0 04 D0 D9 A9
4280  00 8D 6D 03 8D 96 03 60
4288  7F 7F 00 00 7F 7F 00 00
4290  FF FF 00 00 FF FF 00 00
4298  7F 7F 00 00 7F 7F 00 00
42A0  FF FF 00 00 FF FF 00 00
42A8  7F 7F 00 00 7F 7F 00 00
42B0  FF FF 00 00 FF FF 00 00
42B8  7F 7F 00 00 7F 7F 00 00
42C0  EE 6E 03 AD 6E 03 29 01
42C8  8D 6E 03 C9 00 F0 01 60
42D0  AD 49 03 C9 01 F0 01 60
42D8  EE 6D 03 AD 6D 03 C9 FF
42E0  D0 06 A9 02 8D 49 03 60
42E8  AD 6D 03 29 03 C9 03 F0
42F0  01 60 20 80 43 AD 6D 03
42F8  29 C0 C9 C0 F0 01 60 A0
4300  00 B9 28 D0 29 0F C9 00
4308  F0 08 C9 06 F0 0A C9 01
4310  F0 0E C8 C0 04 D0 EA 60
4318  A9 01 99 28 D0 18 90 F2
4320  A9 06 99 28 D0 18 90 EA
4328  00 00 7F 7F 00 00 7F 7F
4330  00 00 FF FF 00 00 FF FF
4338  00 00 7F 7F 00 00 7F 7F
4340  AD 49 03 C9 02 F0 01 60
4348  A9 00 8D 03 D4 A0 00 B9
4350  F9 07 C9 F4 D0 12 A9 F2
4358  99 F9 07 98 18 69 02 13
4360  99 28 D0 A9 01 99 8D 03
4368  C8 C0 04 D0 E2 A9 00 8D
4370  6D 03 8D 49 03 8D 96 03
4378  60 00 7F 7F 00 00 7F 7F
4380  A9 00 8D 03 D4 A9 14 8D
4388  0C D4 A9 11 8D 0D D4 A9
4390  00 8D 07 D4 AD 6D 03 C9
4398  FB D0 0B A9 2D 8D 08 D4
43A0  F9 11 8D 03 D4 60 4A 13
43A8  4A 18 4A 18 69 2D 18 8D
43B0  08 D4 A9 11 8D 0D D4 60
43B8  00 00 7F 7F 00 00 7F 7F
43C0  F9 00 8D 04 D4 A9 11 8D
43C8  04 D4 A9 09 8D 05 D4 A9
43D0  81 8D 06 D4 A9 0F 8D 18
43D8  14 A9 00 8D C8 03 A2 00
43E0  F0 13 20 80 41 AD C8 03
43E8  4A 18 8D C9 03 A9 00 8D
43F0  00 D4 A9 10 38 ED C9 03
43F8  18 8D 01 D4 EE C8 03 18
4400  C9 08 D0 DA A9 00 8D 04
4408  14 6A 0A 0A 7F 7F 00 00
4410  FF FF 00 00 FF FF 00 00
4418  7F 7F 00 00 7F 7F 00 00
4420  FF FF 00 00 FF FF 00 00
4428  7F 7F 00 00 7F 7F 00 00
4430  FF FF 00 00 FF FF 00 00
4438  7F 7F 00 00 7F 7F 00 00
4440  A9 00 8D 04 D4 A9 11 8D
4448  04 D4 A9 09 8D 05 D4 A9
4450  01 8D 06 D4 A9 0F 8D 18
4458  D4 A9 00 8D C8 03 A2 00
4460  A0 13 20 80 41 AD C8 03
4468  4A 18 8D C9 03 A9 00 8D
4470  00 D4 A9 18 38 ED C9 03
4478  18 8D 01 D4 EE C8 03 18
4480  C9 08 D0 DA F9 00 8D 04
4488  D4 60 80 80 FF FF 80 80
4490  FF FF 00 00 FF FF 00 00
4498  FF FF 80 80 FF FF 80 80
44A0  FF FF 00 00 FF FF 00 00
44A8  FF FF 80 80 FF FF 80 80
44B0  FF FF 00 00 FF FF 00 00
44B8  FF FF 80 80 FF FF 80 80
44C0  A9 3A AD A3 D4 A9 38 8D
44C8  02 D4 A9 0F 8D 18 D4 A9
44D0  00 3D 04 D4 A9 24 8D 05
44D8  D4 A9 00 81 06 D4 A9 F5
44E0  8D 30 D4 A9 03 8D 01 D4
44E8  A9 41 8D 04 D4 60 80 80
44F0  FF FF 00 00 FF FF 00 00
44F8  FF FF 80 80 FF FF 80 80
4500  A9 35 8D 05 03 A9 02 8D
4508  85 03 A0 00 20 BF 40 A0
4510  03 31 FB C5 00 D0 19 EE
4518  4E 03 AD 6B 03 18 69 01
4520  33 04 18 EE 6C 33 8D 6B
4528  03 A9 20 91 FB 4C C0 44
4530  C9 28 D0 08 A9 31 8D 94
4538  03 18 90 DB C9 29 D0 06
4540  EE 4D 03 18 90 1E C9 2A
4548  F0 F6 C9 2B D0 2C AD 4D
4550  03 18 69 05 18 8D 4D 03
4558  38 E9 0A 90 07 18 8D 4D
4560  03 EE 4C 03 AD 92 03 B5
4568  F3 AD 93 03 85 FC A0 00
4570  A9 20 91 FB C8 91 FB 4C
4578  4A 44 C9 2C F0 D0 C9 2D
4580  F0 05 C9 2E F0 01 60 EE
4588  4C 03 18 90 D7 00 7F 7F
4590  00 00 FF FF 00 00 FF FF
4598  00 00 7F 7F 00 00 7F 7F
45A0  00 00 FF FF 00 00 FF FF
45A8  00 00 7F 7F 00 00 7F 7F
45B0  00 00 FF FF 00 00 FF FF
45B8  00 00 7F 7F 00 00 7F 7F
45C0  A5 C5 C9 0C D0 03 A9 00
45C8  60 C9 17 D0 03 A9 01 60
45D0  C9 06 D0 03 A9 02 60 C9
45D8  03 D0 03 A9 03 60 A9 FF
45E0  60 00 FF FF 00 00 FF FF
45E8  00 00 7F 7F 00 00 7F 7F
45F0  00 00 FF FF 00 00 FF FF
45F8  00 00 7F 7F 00 00 7F 7F
4600  AD 01 DC 29 04 C9 00 D0
4608  03 A9 00 60 AD 01 DC 29
4610  08 C9 00 D0 03 A9 01 60
4618  AD 01 DC 29 01 C9 00 D0
4620  03 A9 02 60 AD 01 DC 29
4628  02 C9 00 D0 03 A9 03 60
4630  A9 FF 60 00 FF FF 00 00
4638  FF FF 80 80 FF FF 80 80
4640  AD 91 03 C9 00 D0 06 20
4648  C0 45 18 90 03 20 00 46
4650  C9 FF D0 01 60 AC 5B 03
4658  BC 87 03 8D 5B 03 A0 00
4660  20 40 40 C9 01 F0 06 AD
4668  87 03 8D 5B 03 60 80 80
4670  FF FF 00 00 FF FF 00 00
4678  FF FF 80 80 FF FF 80 80
4680  84 FD A8 B9 00 D0 18 69
```

(Hex dump continued on page 114)


WHO ARE
the
LORDS
of
MIDNIGHT
The first SPECTRUM
Game to feature
LANDSCAPING

(Hex dump continued from page 112)

```
4680  01 38 E9 18 10 05 FE 10
4690  4A 18 4A 18 4A 18 0A 18
4698  0A 18 09 18 C5 FE F0 01
46A0  60 A4 FD B9 01 D0 18 69
46A8  01 38 E9 32 18 85 FE 18
46B0  4A 18 4A 18 4A 18 0A 18
46B8  0A 18 09 18 C5 FE F0 01
46C0  60 A4 FD C0 00 F0 0C BE
46C8  97 03 20 40 46 81 97 33
46D0  18 90 03 20 40 46 A4 FD
46D8  B9 5B 03 C9 04 D0 01 50
46E0  20 40 43 C9 01 D0 01 50
46E8  A4 FD A9 04 99 5E 03 50
46F0  FF FF 00 00 FF FF 00 30
46F8  FF FF 80 80 FF FF 80 30
4700  00 00 FF FF 00 00 FF FF
4708  00 00 7F 7F 00 00 7F 7F
4710  00 00 FF FF 00 00 FF FF
4718  00 00 7F 7F 00 00 7F 7F
4720  00 00 FF FF 00 00 FF FF
4728  00 00 7F 7F 00 00 7F 7F
4730  00 00 FF FF 00 00 FF FF
4738  00 00 7F 7F 00 00 7F 7F
4740  C9 04 D0 01 60 C9 00 D0
4748  4E BD 00 D0 38 E5 01 80
4750  10 9D 00 D0 AD 10 D0 38
4758  E5 FD 18 8D 10 D0 18 90
4760  04 18 90 00 D0 BD 00 D0
4768  C9 17 D0 18 AD 10 D0 25
4770  FD C9 00 D0 0F A9 4A 9D
4778  00 D0 AD 10 D0 18 65 FD
4780  18 8D 10 D0 C0 00 D0 01
4788  60 B9 F8 07 C9 F4 D0 01
4790  60 A9 F0 99 F8 07 60 C9
4798  01 D0 4E BD 00 D0 18 69
47A0  01 90 11 18 9D 00 D0 AD
47A8  10 D0 18 65 FD 18 8D 10
47B0  D0 18 90 03 9D 00 D0 BD
47B8  00 D0 C9 4B D0 18 AD 10
47C0  D0 25 FD C9 00 F0 0F A9
47C8  18 9D 00 D0 AD 10 D0 38
47D0  E5 FD 18 8D 10 D0 C0 00
47D8  D0 01 60 B9 F0 07 C9 F4
47E0  D0 01 60 F9 F1 99 F8 07
47E8  50 C9 02 D0 1D BD 01 D0
47F0  38 E9 01 18 9D 01 D0 C0
47F8  00 D0 01 60 B9 F8 07 C9
4800  F4 D0 01 60 A9 F2 99 F8
4808  07 60 BD 01 D0 18 69 01
4810  18 9D 01 D0 C0 00 D0 01
4818  50 B9 F8 07 C9 F4 D0 01
4820  50 A9 F3 99 F8 07 60 00
4828  FF FF 80 80 FF FF 80 80
4830  FF FF 00 00 FF FF 00 00
4838  FF FF 80 80 FF FF 80 80
4840  A9 01 85 FD A0 00 A2 00
4848  B9 5B 03 20 40 47 C8 E8
4850  E8 86 FT 18 AD 6D 03 29
4858  01 C9 01 F0 04 C0 05 D0
4860  E7 60 00 00 FF FF 00 00
4868  FF FF 80 80 FF FF 80 80
4970  FF FF 00 00 FF FF 00 00
4878  FF FF 80 80 FF FF 80 80
4880  AD 1B D4 8D A5 03 AC F4
4888  03 AE A3 03 20 80 41 FD
4890  1B D4 8D A6 03 29 C0 C9
4898  00 F0 01 60 AD F5 03 C9
48A0  09 F0 01 60 AD 92 03 E5
48A8  FB AD 93 03 35 FC AD F6
4880  03 29 06 C9 06 D0 02 F9
48B8  00 18 69 29 18 A0 00 51
48C0  FB 18 69 01 18 C8 91 FB
48C8  AA A5 FC 18 59 D4 18 85
48D0  FC 8A A0 00 C9 2A D0 08
48D8  A9 02 91 FB C8 91 FB 60
48E0  C9 2C F0 F4 A9 08 18 90
48E8  EF 7F 00 00 7F 7F 00 00
48F0  FF FF 00 00 FF FF 00 00
48F8  7F 7F 00 00 7F 7F 00 00
4900  AD 10 D0 25 FD C9 00 F0
4908  03 A9 0A 60 39 02 D0 38
4910  ED A1 03 B0 03 A9 00 60
4918  18 B9 02 D0 38 ED A2 03
4920  90 04 18 A9 00 60 B9 03
4928  D0 38 ED 9F 03 D0 03 A9
4930  00 60 18 B9 03 D0 38 ED
4938  A0 03 90 04 18 A9 00 63
4940  A9 01 60 FF 00 00 FF FF
4940  A5 80 FF FF 80 80 FF FF
4950  00 00 FF FF 00 00 FF FF
4958  80 80 FF FF 80 80 FF FF
4960  00 00 FF FF 00 00 FF FF
4968  80 80 FF FF 80 80 FF FF
4970  00 00 FF FF 00 00 FF FF
4978  80 80 FF FF 80 80 FF FF
4980  ED 1E C0 18 29 01 18 C9
4988  00 D0 01 60 A0 00 A9 02
4990  E5 FD AD 1E C0 25 FD C9
4998  00 F0 0E 20 40 50 C9 00
49A0  F0 07 B9 8D 03 C9 03 D0
49A8  08 06 FD C8 C0 04 D0 E2
49B0  60 B9 F9 07 C9 F4 F0 06
49B8  A9 01 8D 95 03 60 A9 03
49C0  99 9D 03 A9 00 99 28 D0
49C8  A9 F0 99 F9 07 EE 96 03
49D0  AD 96 03 C9 01 D0 19 A9
49D8  02 18 6D 4D 03 18 8D 4D
49E0  03 38 E9 0A 90 07 18 8D
49E8  4D 03 EE 4C 03 4C C0 43
49F0  C9 02 D0 05 A9 04 18 90
49F8  E0 C9 03 D0 05 A9 08 18
4A00  90 07 EE 4C 03 A9 06 18
4A08  90 CF 80 80 FF FF 80 80
4A10  FF FF 00 00 FF FF 00 00
4A18  FF FF 80 80 FF FF 80 80
4A20  FF FF 00 00 FF FF 00 00
4A28  FF FF 80 80 FF FF 80 80
4A30  FF FF 00 00 FF FF 00 00
4A38  FF FF 80 80 FF FF 80 80
4A40  A0 00 84 FF B9 A9 03 A4
4A48  02 99 5C 03 C8 20 40 40
4A50  C9 01 F0 0F A4 FF C8 C0
4A58  0A D0 E7 AD A0 03 A4 02
4A60  99 5C 03 60 FF FF 00 00
4A68  FF FF 80 80 FF FF 80 80
4A70  FF FF 00 00 FF FF 00 00
4A78  FF FF 80 80 FF FF 80 80
4A80  20 40 3A A4 02 19 5C 03
4A88  81 AA 03 AD A8 03 8D AD
4A90  03 4C 40 4A FF FF 00 00
4A98  FF FF 80 80 FF FF 80 80
4AA0  FF FF 00 00 FF FF 00 00
4AA8  FF FF 80 80 FF FF 80 80
4AB0  FF FF 00 00 FF FF 00 00
4AB8  FF FF 80 80 FF FF 80 80
4AC0  A5 03 3D A9 03 8D AA 03
4AC8  4C 40 4A 80 FF FF 80 80
4AD0  FF FF 00 00 FF FF 00 00
4AD8  FF FF 80 80 FF FF 80 80
4AE0  FF FF 00 00 FF FF 00 00
4AE8  FF FF 80 80 FF FF 80 80
4AF0  FF FF 00 00 FF FF 00 00
4AF8  FF FF 80 80 FF FF 80 80
4B00  2E C0 3A C9 FF D0 03 4C
4B08  40 4A AD AA 03 49 01 18
4B10  81 AC 33 A4 02 B9 5C 03
4B18  81 AB 03 4C 40 4A 7F 7F
4B20  00 00 FF FF 00 00 FF FF
4B28  00 00 7F 7F 00 00 7F 7F
4B30  00 00 FF FF 00 00 FF FF
4B38  00 00 7F 7F 00 00 7F 7F
4B40  AD 1B D4 29 03 8D A9 03
4B4E  49 01 18 8D AB 03 A4 02
4B50  B5 5C 03 8D AA 03 AD AB
4B5E  03 8D AC 03 4C 40 4A 7F
4B60  00 00 FF FF 00 00 FF FF
4B6E  00 00 7F 7F 00 00 7F 7F
4B70  00 00 FF FF 00 00 FF FF
4B7E  00 00 7F 7F 00 00 7F 7F
4B80  A9 02 8D A9 03 A4 02 B9
4B8E  5C 03 29 01 AT AA 33 49
4B90  01 18 8D AB 03 4C 40 4A
4B9E  00 00 7F 7F 00 00 7F 7F
4BA0  00 00 FF FF 00 00 FF FF
4BAA  00 00 7F 7F 00 00 7F 7F
4BB0  00 00 FF FF 00 00 FF FF
4BB8  00 00 7F 7F 00 00 7F 7F
4BC0  B9 02 D0 38 E9 AF 90 21
4BC8  18 90 98 03 AD 13 D0 25
4BD0  FD C9 00 D0 09 8D 99 03
4BD8  A9 00 8D 9A 03 60 A9 01
4BE0  8D 99 03 A9 00 8D 9A 03
4BE8  60 A9 AF 38 F9 02 D0 18
4BF0  BD 98 03 AD 10 D0 25 FD
4BF8  C9 00 D0 09 8D 99 03 A9
4C00  01 8D 9A 03 60 A9 00 8D
4C08  99 03 38 ED 98 03 18 8D
4C10  98 03 A9 00 8D 9A 03 60
4C18  FF FF 80 80 FF FF 80 80
4C20  FF FF 00 00 FF FF 00 00
4C28  FF FF 80 80 FF FF 80 80
4C30  FF FF 00 00 FF FF 00 00
4C38  FF FF 80 80 FF FF 80 80
4C40  20 CA 4B B9 03 D0 38 ED
4C48  9E 03 90 0C 18 8D 9B 03
4C50  A9 00 8D 9C 03 18 90 10
4C58  AD 9E 03 38 F9 03 D0 18
4C60  8D 9B 03 A9 01 8D 9C 03
4C68  AD 98 03 38 ED 9B 03 B0
4C70  0F AD 99 03 C9 00 D0 08
4C78  AD 9C 03 18 69 02 18 60
4C80  18 AD 9A 03 60 FF 00 00
4C88  FF FF 80 80 FF FF 80 80
4C90  FF FF 00 00 FF FF 00 00
4C98  FF FF 80 80 FF FF 80 80
4CA0  FF FF 00 00 FF FF 00 00
4CA8  FF FF 80 80 FF FF 80 80
4CB0  FF FF 00 00 FF FF 00 00
4CB8  FF FF 80 80 FF FF 80 80
4CC0  B9 02 D0 38 ED 00 D0 90
4CC8  4A 18 ED 98 03 AD 10 D0
4CD0  25 FD C9 00 D0 06 8D 99
4CD8  03 18 90 05 A9 01 8D 99
4CE0  03 AD 10 D0 29 01 38 ED
4CE8  99 03 90 21 18 C9 01 F0
4CF0  09 8D 99 03 A9 00 8D 9A
4CF8  03 60 A9 01 8D 9A 03 A9
4D00  00 8D 99 03 38 ED 98 03
4D08  18 8D 98 03 60 A9 00 8D
4D10  9A 03 60 AD 00 D0 38 F9
4D19  02 D0 10 CD 00 03 AD 10
4D20  D0 25 FD C9 00 D0 06 8D
4D28  99 03 18 90 05 A9 01 8D
4D30  99 03 AD 10 D0 29 01 38
4D30  ED 99 03 90 18 18 C9 01
4D40  F0 0E A9 01 8D 9A 03 A9
4D48  00 8D 99 03 60 A9 00 8D
4D50  9A 03 A9 01 8D 99 03 60
4D58  A9 00 38 ED 98 03 18 8D
4D60  98 03 A9 00 8D 99 03 8D
4D68  9A 03 60 7F 00 00 7F 7F
4D70  00 00 FF FF 00 00 FF FF
4D78  00 00 7F 7F 00 00 7F 7F
4D80  20 C0 4C B9 03 D0 38 ED
4D88  81 D0 90 0C 18 8D 9B 03
4D90  A9 00 8D 9C 03 18 90 10
4D98  AD 01 D0 38 F9 03 D0 18
4DA0  8D 9B 03 A9 01 8D 9C 03
4DA8  E0 01 D0 10 AD 9C 03 49
4DB0  01 8D 9C 03 AD 9B 03 49
4DB8  01 8D 9F 03 AD 98 03 38
4DC0  ED 9B 03 B0 13 AD 99 03
4DC8  C9 00 D0 0C E0 01 F0 0C
4DD0  AD 9C 03 18 59 02 18 60
4DD8  E0 01 F0 F4 AD 9A 03 60
4DE0  00 00 FF FF 00 00 FF FF
4DE8  00 00 7F 7F 00 00 7F 7F
4DF0  00 00 FF FF 00 00 FF FF
4DF8  00 00 7F 7F 00 00 7F 7F
4E00  98 0A A8 23 00 49 A4 02
4E08  C9 01 F0 03 4C CB 4E A9
4E10  05 99 8D 03 4C 58 4F 00
4E18  FF FF 80 80 FF FF 80 80
4E20  FF FF 00 00 FF FF 00 00
4E28  FF FF 80 80 FF FF 80 80
4E30  FF FF 00 00 FF FF 00 00
4E38  FF FF 80 80 FF FF 80 80
4E40  AD 98 03 C9 00 F0 03 4C
4E49  CB 4E AD 99 03 C9 00 D0
4E50  F6 AD 9B 03 C9 00 D0 EF
4E58  A4 02 A9 04 99 8D 03 4C
4E60  44 4F 00 00 FF FF 00 00
4E68  FF FF 00 00 FF FF 80 80
4E70  FF FF 00 00 FF FF 00 00
4E78  FF FF 80 80 FF FF 80 80
4E80  A0 00 A2 28 20 80 41 AD
4E88  1B D4 29 03 C9 00 D0 08
4E90  A9 01 A4 02 99 8D 03 60
4E98  C9 01 F0 F4 C9 02 D0 03
4EA0  A9 00 A4 02 99 8D 03 60
4EA8  A9 02 A4 02 99 8D 03 60
4E30  FF FF 00 00 FF FF 00 00
4E38  FF FF 80 80 FF FF 80 80
4EC0  A0 00 84 02 A9 02 85 FD
4EC8  18 90 0D A4 02 C8 84 02
4ED0  C0 04 D0 01 60 06 FD 18
4ED8  FD 10 D0 25 FD 18 8D 83
4EE0  03 9A AA A8 B9 02 D0 18
4EE8  69 01 38 E9 18 18 85 FE
4EF0  18 4A 18 4A 18 4A 18 0A
4EF8  18 0A 18 0A 18 C5 FE D0
4F00  CA B9 03 D0 A4 02 18 69
4F08  01 38 E9 32 18 85 FE 18
4F10  4A 18 4A 18 4A 18 0A 18
4F18  0A 18 0A 18 C5 FE D0 A8
4F20  B9 5C 03 49 01 8D A0 03
4F28  B9 8D 03 C9 03 D0 11 98
4F30  0A A8 18 20 40 4C A4 02
4F38  20 80 4A A4 02 4C 40 4E
4F40  C9 04 D0 08 20 C0 4A A4
4F48  02 4C 00 4E 98 0A A8 20
4F50  00 49 A4 02 C9 01 D0 15
4F58  19 28 D0 C9 F0 D0 08 98
4F60  18 69 02 18 99 28 D0 20
4F68  80 4B 4C CB 4E AD 1B D4
4F70  29 FE 18 C9 FC D0 03 20
4F78  80 4E B9 8D 03 C9 00 D0
4F80  06 20 40 4B 4C CB 4E C9
4F88  01 D0 10 A2 00 98 0A A8
4F90  20 80 4D A4 02 20 80 4A
4F98  18 9A AD A2 01 98 0A A8
4FA0  20 80 4D A4 02 20 00 43
4FA8  4C CB 4E 7F 00 00 7F 7F
4FB0  00 00 FF FF 00 00 FF FF
4FB8  00 00 7F 7F 00 00 7F 7F
4FC0  20 00 40 20 C0 41 20 40
4FC8  43 20 C0 42 20 40 42 20
4FD0  80 48 20 00 45 A9 00 A0
4FD8  00 20 80 46 20 40 48 AD
4FE0  1E D0 20 80 49 AD 95 03
4FE8  C9 31 D0 03 A9 FF 60 AD
4FF0  8B 33 CD 6E 03 D0 0B AD
4FF8  8C 33 CD 6L 03 D0 03 A9
5000  80 60 A5 CE C9 3F D0 01
5008  63 AC A4 03 AE 93 03 20
5010  83 41 20 C0 4E 18 90 A8
5018  7F 7F 00 00 7F 7F 00 00
5020  FF FF 00 00 FF FF 00 00
5028  7F 7F 00 00 7F 7F 00 00
5030  FF FF 00 00 FF FF 00 00
5038  7F 7F 00 00 7F 7F 00 00
5040  AD 10 D0 25 FD C9 00 F0
5048  02 A9 01 8D B4 33 98 0A
5050  A8 B9 02 D0 39 ED 01 D0
5058  B8 07 AD 01 D3 38 F9 03
5060  D0 38 E9 0B 92 0B 18 9E
5068  4A 18 A8 A9 03 60 B9 02
5070  D0 38 ED 00 D3 D0 0C AI
5078  00 D0 38 F9 02 D0 18 A2
5080  01 90 02 A2 03 8D B5 03
5088  38 E9 0F 90 35 AD 10 D0
5090  29 01 CD B4 03 F0 25 EE
5099  01 F0 0E C9 01 D0 1D AD
50A0  B4 03 C9 00 D0 16 18 90
50A8  0B C9 00 D0 0F AD B4 03
50B0  C9 01 D0 08 AD 35 03 18
50B8  69 F1 90 11 98 4A 18 A8
50C0  A9 00 60 AD 10 D0 29 01
50C8  CD B4 03 D0 EF 98 4A 18
50D0  A8 A9 01 60 FF FF 00 00
```



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SQUARES

Keith Miles with a Basic program for the BBC Micro that makes use of EOR printing and multi-colour characters. This makes Squares shorter to type in and faster to play.

SQUARES IS A variation on an arcade game written by several software houses.

The aim of Squares is to guide your boot around the grid, colouring each line and square traversed. The values shown in the squares are added to your score as they are made. To make it interesting a monster is pursuing you. This creature will erase all lines you have coloured that do not form a part of a square. There are also immobile monsters that periodically jump to new locations which you should be careful not to run into. As you proceed to higher levels the number of these latter monsters increases as does the frequency of their movements.

The particular features of this game that make it different from most games previously written in Basic is that it makes extensive use of Exclusive Or — EOR — colour printing and multicolour characters.

Shorter and faster

When printing at the Graphics Cursor — VDU 5 — it is possible to superimpose defined or any other characters on top of each other. Using different colours for the different features of the character to be created, the character is assembled by moving the cursor to the required location and successively selecting the foreground colour of the part of the character to be printed, printing it and moving the cursor back over the character.

In Basic this would take the form:

```
VDU5 : MOVE X,Y : GCOL3,Y1 :
PRINT CHR$(X1) : VDU8 : GCOL3,Y2 :
PRINT CHR$(X2)
```

etc., where X,Y are the desired screen co-ordinates, Y1 the colour of character X1 and Y2 the colour of character X2. The VDU commands cause printing to take place at the graphics cursor and move the cursor one space left respectively. The man, squares and walls in the game are constructed on this way. These commands can all be replaced and strung together as VDU commands eg., MOVE is VDU25,4,X;Y; GCOL is VDU18, 3,Y1 and PRINT is simply VDUX2. For example, the above line of Basic would now read:

```
VDU5,25,4,X;Y;18,3,Y1,X1,8,18,3,Y2,X2
```

Not only is this shorter but it executes faster. This is very important for the more complicated a character is the longer it takes to print and the slower movement will be.

EOR printing is important when coloured characters are to be moved. Refer to the User Guide for a detailed explanation, but when printing graphics characters colour is chosen with GCol x,y where function x determines how colour y will be printed. x can have five values 0,1,2,3,4 which respectively print the colour, Or it with the colour already there, And it the colour already there, EOR it etc and Invert it etc. EOR (3) is used because it is possible to predict the outcome of function and by careful manipulation of the colour palette using VDU 19 to enable characters to move over other characters.

For example, Red — colour 1 — EORed with Blue — colour 4 — gives Magenta — colour 5 — if a red character is printed on top of a blue character, but if colour 5 is redefined to be red — VDU19,5,1,0,0,0 — that part of the red character over the blue character will show red not magenta. The EOR values needed are mathematically derived but can be easily found by using the BBC's own EOR function — type 1 EOR 4 to check the above example.

The game itself consists of a series of linked procedures which are called from within a Repeat Until loop which controls the game.

Program 1

```
10MODE2
20VDU23,1,0;0;0;0;
30VDU23,224,31,23,31,23,127,255,0,0,23,225,0,0,0,0,
0,0,255,215:REM Boot, sole
40VDU23,226,126,255,153,153,255,255,255,170,23,227,
0,0,68,102,0,0,0,0:REM Monster ,eyes
50COLOUR1:PRINTTAB(6,1)"SQUARES.":COLOUR2:PRINT'"
 GUIDE YOUR BOOT"'" AROUND THE GRID OF"'"  SQUARES S
CORING"'"  POINTS FOR EACH"'"  COMPLETED SQUARE,"'" WH
ILE AVOIDING THE"'"   BLUE MONSTERS."
60COLOUR4:PRINT'"LINES CAN BE REMOVED  BY THE PURSU
ING"'" MONSTER IF THEY DO"'" NOT FORM A SQUARE."
70COLOUR3:PRINT'"  YOUR MOVEMENT IS"'" CONTROLLED B
Y THE"'"    CURSOR KEYS."
80COLOUR1:PRINT'"  <RETURN> TO PLAY"'
90COLOUR1
100VDU28,3,31,17,23
110*FX21,0
120IFINKEY(-74) MODE7:CHAIN"Square2"
130GOTO110
```

Variables.

lvl% — level, bootx% and monsterx% — horizontal position, booty% and monstery% — vertical position, right% and HORZ% — 0 or 1 moving right or left, Down% and VERT% — 0 or 1 moving up or down, colour% and COLOR% — colour of line traversed, col% and COL% — colour of line coloured, (oldx%, oldy%, OLDX%, OLDY%) — starting coordinates of move, (hor%, ver%, HOR%, VER% — destination coordinates of move, linedown% and linacross% positions on the grid stored as a decimal eg., 27 = intersection 2 across and 7 up, across% and down% — old horizontal and vertical location of monster, fill% — flag for number of squares filled, hit% — flag for identifying game over.

Program 2.

```
   1*KEY 4"TAPE!MDELETE1,1!MFN0!X=0 TO TOP-PAGE STEP4
:IX!&E00=IX!&1900:NEXT!MPAGE=&1001MEND!MRUNM
   2*FX138,0,128
   3END
   5REM Delete lines 1 to 5 if Disc Interface not fitted
   10DIMX(7),Y%(30),gcX(6,9),linecross%(6,10),linedo
wn%(7,9),HZ%(9),HV%(9)
   20ONERROR PRINT,30:REPORT:PRINTERL:END
   30H1%=0
   40MODE2
   50PROCcolour
   60PROCnewgame
   70PROCinit
   80PROCgrid
   90IFlvl%>9 lvl%=9
   100PROCboot(bootx%,booty%)
   110PROCmonster(monsterx%,monstery%)
   120PROCskill monster
   130REPEAT
   140IFINKEY(-26)ANDbootx%<1184ANDbootx%MOD96=16 boot
x%=bootx%+64:right%=1:colour%=FNpt(bootx%+20,booty%-16):P
ROCboot(bootx%+4,booty%):PROCboot(bootx%,booty%):GOTO
190
   150IFINKEY(-122)ANDbootx%<1184ANDbootx%MOD96=16 boot
x%=bootx%+64:right%=0:colour%=FNpt(bootx%+20,booty%-16
):PROCboot(bootx%-64,booty%):PROCboot(bootx%,booty%):G
OTO190
   160IFINKEY(-58)ANDbootx%<976ANDbootx%MOD96=32 boot%
=booty%+32:Down%=0:colour%=FNpt(bootx%,booty%-20):PROC
boot(bootx%,booty%-32):PROCboot(bootx%,booty%):GOTO190
   170IFINKEY(-42)ANDbootx%>112ANDbootx%MOD96=32 boot%
=booty%-32:Down%=1:colour%=FNpt(bootx%,booty%+20):PROC
boot(bootx%,booty%+32):PROCboot(bootx%,booty%)
   180IFcolour%=1 col%=0 ELSE col%=7
   190IFcolour%=7 col%=4
   200GCOL3,col%
   210IFright%=1ANDbootx%MOD192=32 hor%=bootx%DIV192:HO
R%=0:lldx%=X(hor%):lldy%=Y%(hor%):DRAW%(hor%),Y%(ver%):linecross
%=old%*10+oldy%:PROClinecross(linecross%):old%=hor
%:right%=-1:GOTO260
   220IFright%=0ANDbootx%MOD192=32 hor%=bootx%DIV192:HO
R%=1:lldx%(1),Y%(oldy%):DRAW%(hor%),Y%(ver%):linecross
%=hor%*10+ver%:PROClinecross(linecross%):old%=hor%:
right%=-1:GOTO260
   230IFDown%=1ANDbootyMOD96=16 ver%=booty%DIV96-1:MOV
EX%(oldx%),Y%(oldy%):DRAW%(hor%),Y%(ver%):linedown%=h
or%*10+oldy%:PROClinedown(linedown%):oldy%=ver%:Down%=
-1:GOTO260
   240IFDown%=0ANDbootyMOD96=16 ver%=booty%DIV96-1:MOV
EX%(old%),Y%(oldy%):DRAW%(hor%),Y%(ver%):linedown%=h
or%*10+ver%:PROClinedown(linedown%):oldy%=ver%:Down%=-
1
   250IFDOWN%=1THEN HIT%=HIT%+1:PRINTTAB(11,3);HIT%:VDU5
   260PROCmovemonsters:SOUND&10,-6,1,2
   270IFRND(1)>.95-(lvl%/10) PROCrandomemonster:SOUND&10
,-6,2,2
   280colour%=FNPT(bootx%,booty%):IFcolour%=BOF colour%
=4 PROCendhit%=1
   290UNTIL hit%=1OR4111%=54
   300IFhit%=0 lvl%=lvl%+1:GOTO70
   310GOTO60
   320DEFPROCnewgame
   330hit%=0:lvl%=1:HZ%=0
   340ENDPROC
   350DEFPROCinit
   360FORX%=4TO1216STEP192:X1(X%DIV192)=X%:NEXT
   370FORY%=96TO96STEP-96:Y%(Y%DIV96-1)=Y%:NEXT
   380FORX%=0TO6:FORY%=0TO10:linecross%(X%,Y%)=0:NEXT.
   390FORX%=0TO7:FORY%=0TO9:linedown%(X%,Y%)=0:NEXT,
   400bootx%=32:booty%=112:monsterx%=32:monstery%=96:a
cross%=1:down%=0
   410colour%=6:COLOR%=6:VERT%=9:HORZ%=0:right%=0:Down%
=0
   420ui%=4:DIV4%=4:MOD%=1:VB%=0
   430OLX%=0:OLIY%=9:HOR%=0:LER%=9
   440ENDPROC
   450DEFPROCgrid
   460VDU12,4,17,1:PRINTTAB(6,0)"SQUARES"
   470VDU5,10,0,4
   480FORIX%=96TO32STEP-9:MOVE64,IX:DRAW1216,IX:NEXT
   490FORIX%=4TO1216STEP192:MOVEIX,96:DRAWIX,960:NEXT
   500VDU4,17,11:sc%=0:fil%=0:FORIX%=1TO6:X%=0:FORJX%=9T
O1STEP-1:X%=X%+2:sc%(IX,JX)=RND(9):PRINTTAB((IX*3)-1,K
%)sc%(IX,JX):NEXT,
   510COLOUR2:PRINTTAB(1,30)"SCORE"TAB(1,31);SCX;:COLOU
R3:PRINTTAB(11,30)"HI-SCORE"TAB(11,31);HI%;:VDU5
   520ENDPROC
   530DEFPROCend
   540FORIX%=1TO10:SOUND&10,-12,6,10:FORJX=1TO10:VDU9,0
,RND(6):0;FORJ=1TO50:NEXT,,
   550VDU19,0,0;0;4,17,1:PRINTTAB(2,14;"<RETURN> TO PLA
Y"TAB(3,16)'<SPACE> TO END"
```

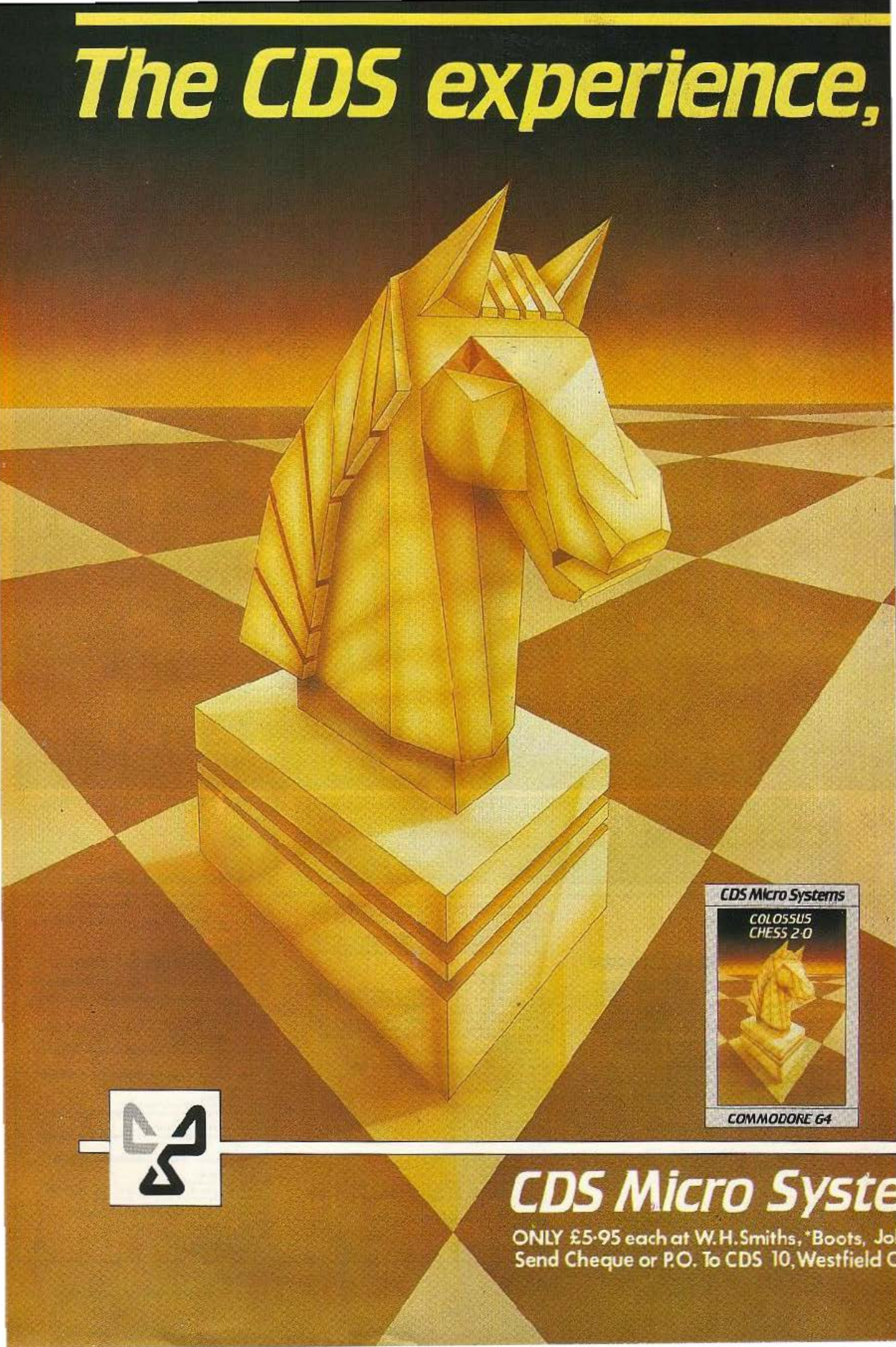
Arrays

X%(—),Y%(—)—horizontal and vertical locations of grid intersections on Graphics grid.
sc%(X,Y)—square scores.
linecross%(X,Y)—status of horizontal lines (0 not traversed or wiped by monster, 1 traversed, 2 secure in a square).
linedown%(X,Y)—status of vertical lines.
MX(—),MY(—)—horizontal and vertical locations of still monsters.

BBC

```
5A0MODE21,0
570IFINKEY(-74) ENDPROC
580IFINKEY(-99) VDU22,7:END
590GOTO560
600DEFPROCmonster
610across%=monster%
620down%=monster%
630IFmonster%=boots%THEN650 ELSE VERT%=-16:IFboots%
<monster% level%=-31:HORZ%=20:ELSE level%=31:HORZ%=-2
0
640monster%=monster%+(monster%>boots%)-(monster%
<boots%)+level%:IFmonster%MOD96<>.6THENmonster%=mac
ross%
650IFmonster%=bootsY%THEN670 ELSE HORZ%=0:IFbootsY%<m
onster%THENup%=-15:VERT%=0 ELSE up%=15:VERT%=-20
660monster%=monster%+(monster%<boots%)-(monster%
%boots%)+up%:IFmonster%MOD192<>32THENmonster%=down
%
670COLOR5=FNpl(monster%+HORZ%,monster%+VERT%)
680IFCOLOR5=10RCOLOR5=9 COL%=7 ELSE COL%=0
690PROCmonsterlacross%,down%)
700PROCmonster(monster%,monster%
710GCOL3,COL%
720IFmonster%MOD192=32 HORZ=monster%DIV192:PROCunc
oMoLDX%=HORZ
730IFmonster%MOD96=16 VERT=monster%DIV96 1:PROCunc
oMoLDY%=VERT%
740ENDPROC
750DEFPROCmonster(X%,Y%)
760VDU25,4,X%;Y%;18,3,0,226,0,18,3,7,227
770ENDPROC
780DEFPROCboot(X%,Y%)
790VDU25,4,X%;Y%;18,3,9,224,0,18,3,3,225
800ENDPROC
810DEFPROCline(mecross%)
820A%=X%DIV20:B%=Y%MOD16
830IFlinecross%(A%,B%)=0 linecross%(A%,B%)=1
840PROCsquare_(A%,B%)
850ENDPROC
860DEFPROCline(medown%)
870A%=X%DIV20:B%=Y%MOD16
880IFlinedown%(A%,B%)=0 linedown%(A%,B%)=1
890PROCsquareup(A%,B%)
900ENDPROC
910DEFPROCsquare_(a%,b%)
920IFa%=0ORa%=0THEN940
930IFlinecross%(a%,b%-1)<>0AND linedown%(a%-1,b%
)<>0AND linedown%(a%,b%)<>0AND sc%(a%,b%)<>0 PROC
drawsquare(a%-1,b%-1):PROCscoredacross(a%,b%)
940IFa%=20Rb%=9THEN960
950IFlinecross%(a%,b%+1)<>0AND linedown%(a%-1,b
%+1)<>0AND linedown%(a%,b%+1)<>0AND sc%(a%,b%+1)<>
0 PROCdrawsquare(a%-1,b%):PROCscoredacross(a%,b%+1
)
960ENDPROC
970DEFPROCsquareup(a%,b%)
980IFa%=20Rb%=0THEN1000
990IFlinedown%(a%-1,b%)<>0AND linecross%(a%,b%)
<>0AND linecross%(a%,b%-1)<>0AND sc%(a%-1,b%)<>0 PR
OCdrawsquare(a%-1,b%-1):PROCscoredup(a%,b%)
1000IFa%=0ORb%=0THEN1020
1010IFlinedown%(a%+1,b%)<>0AND linecross%(a%+1,b
%)<>0AND linecross%(a%+1,b%-1)<>0AND sc%(a%+1,b%)
<>0 PROCdrawsquare(a%,b%-1):PROCscoredup(a%+1,b%)
1020ENDPROC
1030DEFPROCdrawsquare(z%,z%)
1040VDU5,18,0,6
1050MOVEX%(z%),Y%(z%):MOVEX%(z%+1),Y%(z%)
1060PLOT85,X%(z%),Y%(z%+1)
1070MOVEX%(z%+1),Y%(z%+1)
1080PLOT85,X%(z%+1),Y%(z%)
1090ENDPROC
1100DEFPROCscoredacross(X%,Y%)
1110linecross%(X%,Y%)=2
1120linecross%(X%,Y%-1)=2
1130linedown%(X%-1,Y%)=2
1140linedown%(X%,Y%)=2
1150sc%=sc%+sc%(X%,Y%):sc%(X%,Y%)=0:PROCprint
1160ENDPROC
1170DEFPROCscoredup(X%,Y%)
1180linedown%(X%,Y%)=2
1190linedown%(X%-1,Y%)=2
1200linecross%(X%,Y%)=2
1210linecross%(X%,Y%-1)=2
1220sc%=sc%+sc%(X%,Y%):sc%(X%,Y%)=0:PROCprint
1230ENDPROC
1240DEFPROCprint
1250VDU4:COLOUR2:PRINTTAB(1,3);SC%;:VDU3
1260ENDPROC
1270ENDPROC
1280DEFPROCstillmonster
1290FORI%=0TO 19:
1300X%(I%)=RND(7)-1:Z%=RND(10)-1:MX%(I%)=X%(Z%)-32:MY%
(I%)=Y%(Z%)+16
1310pos%=FNpf(MX%(I%)+48,MY%(I%)-44):IFpos%=1THEN1290
1320PROCmonster(MX%(I%),MY%(I%))
1330NEXT
1340ENDPROC
1350DEFPROCrandomonster
1360I%=RND(19)-1:mx%=MX%(I%):my%=MY%(I%)
1370Z%=RND(7)-1:Z%=RND(10)-1:MX%(I%)=X%(Z%)-32:MY%
(I%)=Y%(Z%)+16
1380Pos%=FNpf(MX%(I%)+48,MY%(I%)-44):IFpos%=1ORPos%=3
THEN1370
1390PROCmonster(mx%,my%):PROCmonster(MX%(I%),MY%(I%))
1400ENDPROC
1410DEFPROCundoA
1420IFdown%(>monsterY%THEN1480
1430IFSGN(HORZ%)=-1ANDlinecross%(HORZ%,VERT%)=1 linec
ross%(HORZ%,VERT%)=0:GOTO1470
1440IFSGN(HORZ%)=-1THEN1480
1450IflinecrossX(OLDX%,OLDY%)=1 linecrossX(OLDX%,OL
DY%)=VDU10,4/0
1460GOTO1480
1470MOVEX%(OLDX%),Y%(OLDY%):DRAWX%(HORZ%),Y%(VERT%):GOT
O1480
1480ENDPROC
1490DEFPROCundoU
1500IFacross%(>monsterY%THEN1560
1510IFSGN(VERT%)=-1ANDlinedown%(HORZ%,VERT%)=1 linedown
%(HORZ%,VERT%)=0:GOTO1550
1520IFSGN(VERT%)=-1THEN1560
1530IflinedownX(OLDX%,OLDY%)=1 linedownX(OLDX%,OLDY%)
=0:GOTO1550
1540GOTO1560
1550MOVEX%(OLDX%),Y%(OLDY%):DRAWX%(HORZ%),Y%(VERT%)
1560ENDPROC
1570DEFPROCcolour
1580VDU19,1,7;0;:REM 1 white
1590VDU19,7,1;0;19,9,1;0;19,15,1;0;:REM 7,9,15 red
1600VDU19,3,4;0;19,14,4;0;:REM 3,14 blue
1610VDU19,5,3;0;:REM 5 yellow
1620VDU19,13,5;0;19,12,5;0;:REM 13,12 magenta
1630ENDPROC
1640DEFFNpf(dX,dY)
1650FOINT(dX,dY-1)
1660DEFFNpl(X%,Y%)
1670=POINT(X%+32,Y%)
```

The CDS experience,



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LEAPFROG	XXX	1003	BREAKOUT	XXX	2004			
REVERSI	XXX	1004	BRICK-STOP	XXX	2005			
3 D PAINTER	XXX	1005	REVERSI	XXX	2006			
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Good luck. May the power be with you.

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Short range weapon system. Iridium powered. Powered up and operational.

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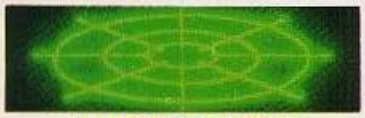
Long range weapon system. Radar homing duodec warhead. Armed and ready to fire.



· RADAR ·

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· SHIELDS ·

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· GAUGES ·

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3D LUNATTACK

Microspeech Compatible

SPACE QUEST — for the 16 or 48K ZX Spectrum makes use of fast machine code and high resolution colour graphics to create a fast shoot-'em-up game.

You are alone in your gleaming nuclear powered spaceship as you steer through the hazardous space lanes until, unwarned, you are attacked by the blue budgies a violent race of creatures who get their kicks out of dropping bombs on passing space ships. If you can survive long enough to kill them all you have to do is steer through and destroy a whole asteroid belt. Next you come across a band of butterfly banditos who like the budgies enjoy bombing passing spaceships. If you can destroy all of these, you have to destroy another asteroid belt and only then can you get back on the space lanes.

This game allows a large number of keys to be used; any key from Caps Shift to V is left, any key from B to spacebar is right and any key from J to Enter is fire in rounds 1 to 4 and thrust in the space lanes.

To enter the program type in listing 1 and save it to tape with

SAVE "SPACE" LINE 1

Next comes the 3K of machine code. Type in listing 2 and run it. When run it will Poke the machine code onto the screen so do not worry if the screen starts getting messy — this is because there is not enough room for the data and the machine code if stored normally. A checksum is used on the data so the computer will tell you the line of any error it finds. If an error does occur, check and correct it and rerun the program. When it Pokes in all the machine code without an error it will save the resultant code.

The program is ready

If you now rewind the cassette the program is ready. Type

LOAD ""

and after loading the Basic program it will auto run and load the machine code into the correct place.

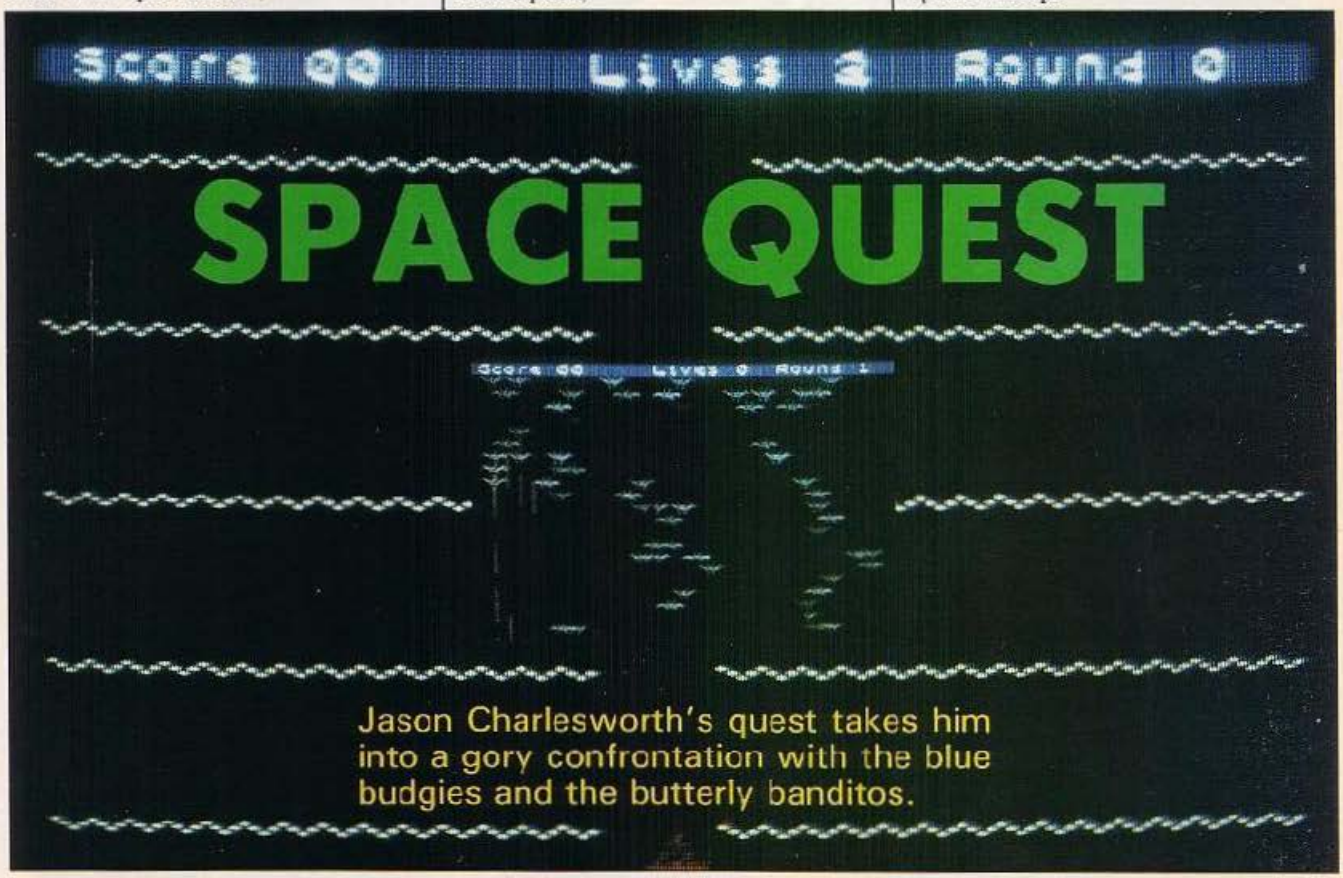
The game is now ready and the instructions should be printed on the screen. When your game is over, if you got a high enough score you will be asked for your name for the high score table. If you wait about 10 seconds when it has printed the instructions a demo mode will be played of all the rounds except the space lanes.

For those who find the game too easy or hard, here are two addresses which could help.

Address 29562 holds how many lives you start off with, normally three, so by Poking it to nine you start with nine lives.

Address 29567 holds how long the pause is. Normally the game is too fast so during the game the program uses this number as the length of the pause between moves, normally 30. A low number makes the game very fast, a high number makes the game slow.

Finally thank-you to, Robert Rhodes, a friend of mine who translated the music to Spectrum Beeps.

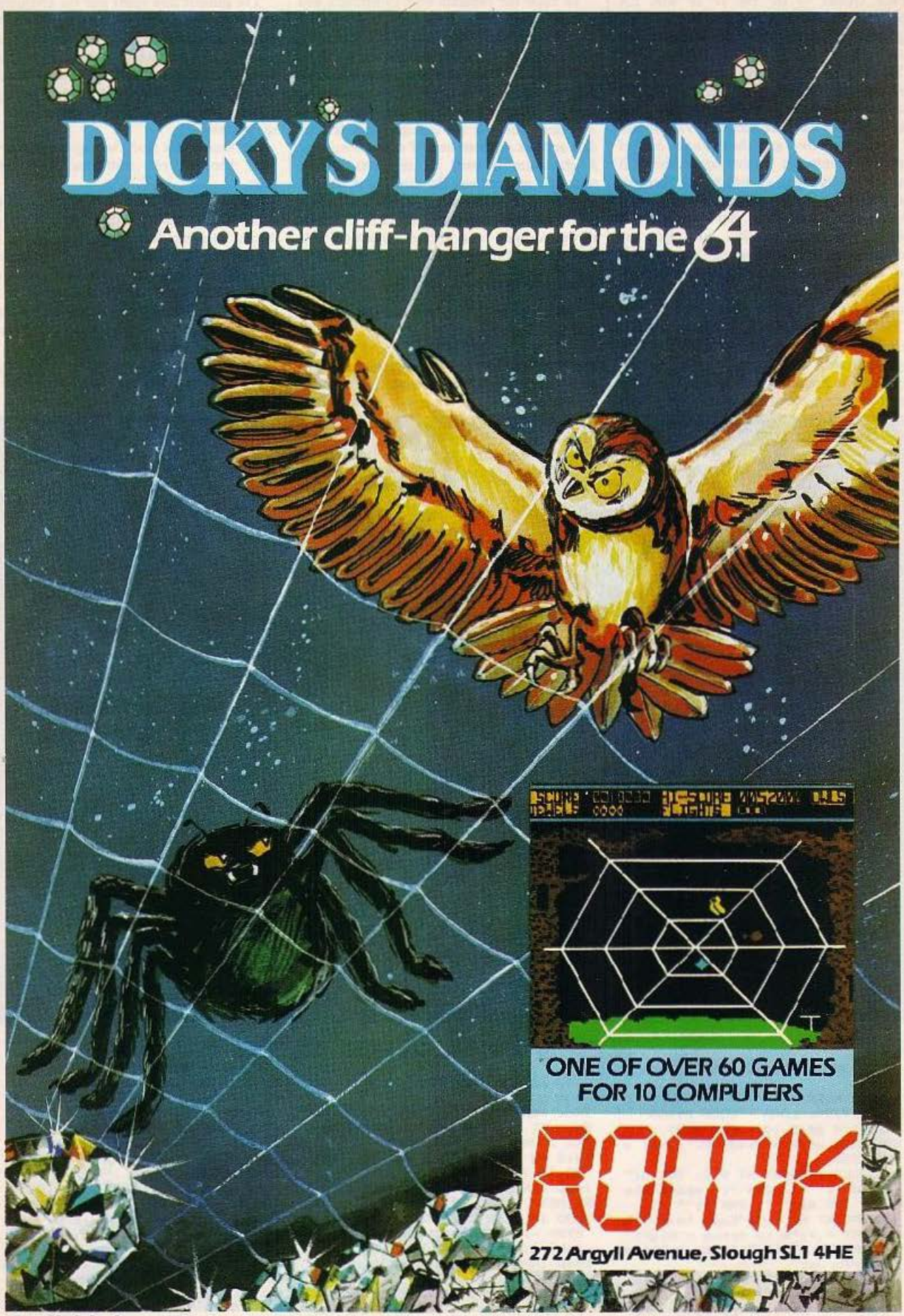


Jason Charlesworth's quest takes him into a gory confrontation with the blue budgies and the butterly banditos.

Space Quest — listing 1.

```
  1 POKE 23675,72: POKE 23676,1
27
  10 BORDER 0: PAPER 0: INK 7: C
LEAR 29399: LOAD ""CODE 29400
  20 DIM a$(5,10): DIM a(5)
  21 LET a$(1)="Jason C.": LET a
(1)=2730
  30 CLS : PRINT AT 0,2; INK 5;"
"; INK 6;"  "; INK 7;" space Que
st "; INK 6;"  "; INK 5;'"
  40 PRINT AT 7,7;"Caps to v = L
eft";AT 9,7;"b to space = Right"
  50 PRINT AT 11,7;"j to enter =
 Fire/Thrust"
  60 PRINT AT 13,7;"h = Halt";AT
 15,7;"s = Start"
  70 PRINT AT 2,6;"By Jason Char
lesworth"
  80 FOR a=1 TO 1000: IF INKEY$=
"s" OR INKEY$="S" THEN GO TO 100
0
  90 NEXT a: RANDOMIZE USR 29400
 100 GO TO 30
1000 POKE 23300,0: LET 1=USR 295
51: LET sc=100*(PEEK 23296+256*P
EEK 23297)+10*PEEK 23298
1010 GO SUB 2000: IF NOT sc THEN
 GO TO 1060
1020 FOR a=1 TO 5: IF sc<a(a) TH
EN NEXT a: GO TO 1060
1030 IF a<>5 THEN FOR b=5 TO a+1
 STEP -1: LET a$(b)=a$(b-1): LET
 a(b)=a(b-1): NEXT b
1040 INPUT "Name please ";a$(a)
1050 LET a(a)=sc
1060 CLS : PRINT PAPER 1; BRIGHT
 1; INK 7;"          Hi-Score tab
le          "
1070 FOR a=1 TO 5: IF a(a) THEN
PRINT AT 5+2*a,5; INK 5;a$(a);"
  ";a(a): NEXT a
1080 PAUSE 200: GO TO 30
2000 LET a=20/76: LET b=a/2: LET
 c=a*3: RESTORE : FOR q=1 TO 36
2010 READ d: IF d=50 THEN PAUSE
1+INT (a*3.33): GO TO 2010
2020 READ e: BEEP d,e: NEXT q
2030 RETURN
2040 DATA a,0,c,7,50,b,0,c,7,50,
b,0,a,7,1.5*b,7,.5*b,7,a,12,a,16
2050 DATA a,7,1.5*b,7,.5*b,7,a+b
,7,50,50,a,16,a,19,a,16,a,12,a,1
9
2060 DATA b,16,b,12,a,19,b,16,b,
12,a,7,1.5*b,7,.5*b,7,a+b,7,a,0,
c,7,50,b,0,a
2070 DATA 7,1.5*b,7,.5*b,7,c,12,
c,16
```

(Listing 2 is on page 123)



Available from Dixons, John Menzies, W.H. Smith, Boots and all good computer stores.

Space Quest — listing 2.

```
   1 DEF FN x(a$)=16*(CODE a$-48
-(39 AND a$(1)>"9"))+(CODE a$(2)
-48-(39 AND a$(2)>"9"))
  10 LET x=16384: FOR a=0 TO 52:
 READ a$: LET t=VAL a$( TO 4): L
ET a$=a$(5 TO ): FOR b=0 TO 63:
LET y=FN x(a$(b*2+1 TO b*2+2)):
POKE x,y: LET t=t-y:: LET x=x+1:
 NEXT b: IF NOT t THEN NEXT a: G
O TO 40
20 PRINT "error line ";a*10+100
  30 STOP
  40 SAVE "Quest"CODE 16384,3367
 100 DATA "6849cd537c3e0132045bc
dab7706c8c50e043e05328f5ccd6376c
d95793a045cfeff2073c110e8cdfc7b3
e0232045bcdab7706c8c50e0c3e03328
f5ccd4776cd2176"
 110 DATA "69623a045cfeff204ec11
0e8cdb3/c3e0332045bcdab7706c8c50
e083e06328f5ccd6376cd95793a045cf
eff2029c110e8cdfc7b3e0432045bcda
b7706c8c50e0e3e"
 120 DATA "723802328f5ccd4776cd2
1763a045cfeff2004c110e8c9c1c9973
2005b32015b32025b3e0332035b3e1e3
20b5bcdd475cda373cdcc74cda373cd5
a75cda373cdc473"
 130 DATA "6284cda373cd5274cda37
318e0218403113200cdb503212c01115
000cdb50321840311320 0cdb50306327
610fdc9cd537c3e0332045b97320a5bc
dab77cdb37ccd4f"
 140 DATA "713678cdd17ccd4f783a0
d5bfe00203bcd3176fe0028330e083e0
6328f5ccd6376cd9579cd4f78cd4f78c
d3176fe002819cd4f78cdd17ccd4f78c
d3176fe0028093a"
 150 DATA "55830d5bfe00200318b6c
997320d5bcd2c77212e5b06197efe0f3
803d60a7723232310f3210e5b061e360
02310fb3a035b3c32035bfe00c2d073c
1c9cdfc7b3e0432"
 160 DATA "7058045bcdab77cdb37c9
7320a5bcdd17ccd4f783a0d5bfe00203
5cd4f780e0e3e02328f5ccd4776cd4f7
8cd2176cd4f783a0d5bfe002018cd4f7
8cdd17ccd4f703e"
 170 DATA "55810d5bfe00200 8cd317
6fe0020bfc9212e5b06197efe0f3803d
60a7723232310f397320d5bcd2c773a0
35b3d32035bfe00208bc1c9cd537c3e0
132045b97320a5b"
 180 DATA "7685cdab77cdb37ccd4f7
8cdd17ccd4f783a0d5bfe00203bcd317
6fe0028330e043e05328f5ccd6376cd9
579cd4f78cd4f78cd3176fe002819cd4
f78cdd17ccd4f78"
 190 DATA "5235cd3176fe0028093a0
d5bfe00200318b6c997320d5bcd2c772
12e5b06197efe0f3803d60a772323231
0f32:0e5b061e36002310fb3a035b3d3
2035bfe00c2d874"
 200 DATA "7025c1c9cdfc7b3e02320
45bcdab77cdb37c97320a5bcdd17ccd4
f783a0d5bfe002035cd4f780e0c3e033
2ef5ccd4776cd4f78cd2176cd4f783a0
d5bfe00201 8cd4f"
 210 DATA "647978cdd17ccd4f783a0
d5bfe00200 8cd3176fe0020bfc9212e5
b06197efe0f3803d60a772323231 0f39
7320d5bcd2c773a035b3d32035bfe002
08bc:c9cdab77cd"
 220 DATA "7163b37c9732045bcd127
701bc02c5cdd17ccd7f763a0d5bfe002
01acd2176cdc076cdd17c3a0d5bfe002
00ac:0b97b920dcb820d9c9c197320d5
bcd2c773a035b3d"
 230 DATA "584232035bfe0020b5c1c
93a0b5bfe00c847c5060010fec110f8c
9212d5b06197e232323e680fe8020041
0f497c93e01c93a0a5be602fe0220040
60218020601cd09"
 240 DATA "56367b3a0a5b3ce603320
a5bc93a0a5be602fe022004060218020
601cd6c/b3a0a5b3ce603320a5bc93a0
55b4ff5fea730030c0c0cc501febfed7
8e60fc1fe0f280c"
 250 DATA "55430d0d0d0d0d3e3cb93
8020e3cf1b9c8c5ed4b055b1e01cd5e7
dc11e003a065b47cd5e7d7932055bc90
605212d5bc5e54e2346cd097a0c0c0c7
9febd382e0e0823"
 260 DATA "6050234697b820043a2e5
b47cdde7b7de6036fcb7c28057885471
8037895477 8fe1c3802061c78fe03300
20603e1e3712370cdad7ae12323c110b
4c9010e0021:e77"
 270 DATA "5685112d5bedb0c9080f2
d0f520f760f9b0f000000000640c5783
de607328f5ced4b055b971e00cdac7d7
9c6084f3e02cdac7dc1c5783de607672
42e01110500cdb5"
 280 DATA "734303c110d23e07328f5
c3e0fed4b055bf5ccde7be5c57ce6036
723110a00cdb503c1e17ce60732f77f7
de6e032ff7f1e003e15cdac7d9732f77
f32ff7f1e013e15"
 290 DATA "708376cdac7d0df13dfe0
020c43e151e00cdac7dc93e07328d5cc
d6b0dcdcd1f21e67706233e4f328f5c7
ed72310fb3e16d797d73e14d73a035bc
630d73e16d797d7"
 300 DATA "51923e1dd73a045bc630d
797cd0978c916000020536 36f7265202
0202020202020204c697665732020205
26f756e6420202020e5c5f5473a025b2
a005b80fe0a3803"
 310 DATA "6115d60a2332025b22005
b473e4f328f5c3e16d73e00d73e07d79
7bc2003bd2807ed4b005bcd1b1a3a025
bc630d73e30c797320f5cf1c1e1c93e0
75bfe00201e01fe"
 320 DATA "5137bfed78e60ffe0fc83
e0132075b2a055b2d2d2d2424242422
0085bc9ed4b085b1e013e11cd727e0d0
d0d0d3e08b938059732075bc9ed43085
bc5040404cd5b7e"
 330 DATA "6218fe00202704cd5b7ef
e00201f0ccd5b7efe0020170c0ccd5b7
efe00200e3e0732 8f5c1e003e11c1cd7
27ec9c13a045be601fe01285f78e6f81
f1f1f4779e6f81f"
 340 DATA "53081f1f4f212d5b1e197
e2323feff283e7eb8203a2b7e23b9203
42b2b36ffcd6b7a3a045bcd097897320
75b234e23463e02328f5c3e12cd237a3
e06328f5c3e13cd"
 350 DATA "6227237a3e0032 8f5c3ef
fcd237ac9231d97bb20b5c978c603e6f
01f1f1f4779e6f81f1f1f4f212d5b1e1
97e2323feff28462b7e23b920407eb32
8093db828053c3c"
 360 DATA "5889b820339732075b2b2
b36ff234e2346cd6b7a3a045bcd09733
e02328f5c3e12cd107a3e03328f5c3e1
3cd107a97328f5c3effcd107ac9231d9
7bb20adc9210e5b"
 370 DATA "4776060ac57efe0028232
34e23461e013e10cd727e79c6044ffeh
438062b2b3600180f2b711e003e07328
f5c3e10cd727e2bc123232310cc210e5
b112d5b060ac57e"
 380 DATA "4872fe00202d1ae680fe8
0200d1313:33e76bb30f11:2d5b18ec1
31aa71717174f131aa7171717c605471
3360123712370 2b2bc123232310c7c9c
d237a043c20013d"
 390 DATA "7154cd237a053dfefe200
13cc9e5c5d5f5feff200511003d1810e
d5b7b5ca7cb17cb17cb17833001145f7
8e61fcb17cb17cb174779e61fcb17cb1
7cb174fcd227f3e"
 400 DATA "73518f5c77cd027fc6081
a13772410faf1d1c1e1c9e5d5c5f5063
221190011010 0e5d5c5cdb503e1d1e12
32310f3f1c1d1e1c9e5d5c5f5500603c
50600cd027f061d"
 410 DATA "609778ba200323232336 0
02310f4c10c10e8f1c1d1e1c9e5d5c5f
5500600cd027f061d7ab820032323239
7bec4017b36c02310ef0c0600cd027f0
61d7ab820032323"
 420 DATA "59852397bec4017b36332
310ef0c0600cd027f061d7ab82003232
32397bec4017b360c2310eff1c1d1e1c
9f53e01320d5bf1c93e02b820010c783
27c5b79327d5b06"
 430 DATA "66041921235bc53a7c5bb
e203e234e23463effcd237ae5cdde7be
be10c79fe1638020e017afe803010e60
23d8047fe202001467 8feff200146702
b713a7d5bcb4728"
 440 DATA "6248033d18013ccd237a2
b7eee03772323 23c110b1c93e02b8200
20c0c78327c5b79327d5b212d5b06:9c
53a7cbbbe204c234e23463effcd107ae
5cdde7bebe17be6"
 450 DATA "5448023d5f7ae6023d577
0834779824f2bfe0020014e79fe16200
14e2378fe0020014678fe1e200146702
b712b3a7d5bcb4f28043d3d18023c3cc
d107a7eee0377c1"
 460 DATA "589323232310a3c9f5c52
929292929292929ed4b765c0901e5430
9ed4b735c092276 5cc1f1c921087c:12
d5b014b0 0edb0c9ff1013ff010fff070
8ff0506ff091301"
 470 DATA "0788061c01030401080 10
1030601020702041b020b08020a16010
9140206030204020113020a0c02100
f02090401100d0103110 1021d0203150
2061a216 87c112d"
 480 DATA "18325b014b00edb097210
e5b061e7710fdc901030501030a01030
f0103140103190205040205090205 0f0
2051502051a01070501070a01070f010
714010719020907"
 490 DATA "369902090c02091202091
7010b0a010c0f010b14020d09020d150
10f0f21cc7c11055b010500edb0ed4b0
53b1e00cd3e7d97320d5bc9a77800000
097ed4b055bcd80"
 500 DATA "74017d3effcd807d3e01c
d807dcd267d97bac0023202 82ed4b055
b6f78fe00200a7dfe0428 0597cd807dc
978fef020067dfe042001c91e01cd5e7
d1e007d8047ed43"
 510 DATA "8399055bcd5e7d7acd807
d97cd807dc9c5f501febfed78e610fe0
0200b01fefded78e602fe0020f511000
001fefeed78e61ffe1f280216ff01fe7
fed78e61ffe1f28"
 520 DATA "6197021601f1c1c997bb2
8073e07328f5c18053e02328f5c97cda
c7d79c6084f3e02cdac7d79d6084fc9d
5c557fe0120063e0f804716ff1e0fcd5
b7efe002805320d"
 530 DATA "71505b180e3effba20030
c1801041d97bb20e6c1d1c9f5c5d5e52
a7b5c8/8/8/8b3001245fe5dde17b32b
05c3a8f5c5f:607788247cd227f7378c
60847cd227f737a"
 540 DATA "7186814fcd227f7378d60
847cd227f7378924cd227f7379924fc
d227f73cd027f32b15c7a08c5ed4bb05
cdd5e00dd560077b02000e7cb1bcb1a1
f10f94797b92810"
 550 DATA "64027b2fa677237a2fa67
723782fa677:80b7eb377237eb277237
eb077dd232b2b7cc13ce60720060ccd0
27f0d25240c79febf20050e00cd027f0
83dfeff20a5e1d1"
 560 DATA "8094c1f1c9c5e5cd027f4
eee0747fe002804cb1910fc79e601e1c
1c9f5c5d5e52a7b5c8787878753001246
fe5cde17b32b05c3a8f5c5f1e0778824
7cd227f737a814f"
 570 DATA "7032cd227f73789247cd2
27f7379924fcd227f73cd027f32b15c7
a08c5ed4bb05cdd5e009757b82807a7c
b1bcb1a10fab9280b7b2fa677237a2fa
677180 7/eb37723"
 580 DATA "71367eb277dd232b7cc13
ce60720060ccd027f0d25240c79febf2
00500e00cd027f083cfeff20b4e1d1c1f
1c979e6c01f:1f6779e63817176f79e
60784c640677 8e6"
 590 DATA "4042f81f1f1f856f78e60
7c90879e6f826006f29297 8e6f81f1f1
f856f3e5884670 8c9000000000000000
000000000000000000010101030306050
00000008080c040"
 600 DATA "68294c4c5b7f7c7942056
464b4fc7c3c844002027bfd87040a004
040debfe12050000462bb1d070402022
046cdb8e02040407289b5c3c:b38d714
e71adc383cdb18e"
 610 DATA "5998021925 2b292b25194
098a4d494d4a4981c1e7efff7e78100
83c7efe7f7e:c183c7ee7dbdbe77e3c3
c7ee7c3c3e77e3c00000010101028101
0282810102800000"
 620 DATA "6160000024181824000000
03c4242424223c00c3c324000024c3c30
078eedbdfff7d00001e7de7fbffbe002
16c1b095e2356237ab32836eb09d5e55
e2356eb09ebe173"
```

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BETTA BASIC

John Judge adds 14 Basic commands to the ZX-81.

THIS SET OF machine-code routines provides the 16K ZX-81 with 14 new Basic statements and commands usually found only on much larger and more expensive machines. The routines take up 1336 bytes in a Rem statement and are designed for ease of use with full error codes. Two of the routines are interrupt driven and allow you to add your own interrupt driven routines.

To enter the program, a 16K ZX-81 with the New run has to be used, it may be possible to use less memory, but some of the routines will crash if the display file is collapsed, ie., RAM is less than 3¼K.

First, line 1 Rem followed by 128 zeros — four lines — is entered. This is then duplicated as line 2 and so on up to line 10. When this has been done, the following are entered as direct commands.

```
POKE 16511,56
POKE 16512,5
POKE 16509,0
POKE 16510,0
POKE 16514,118
POKE 16515,118
1 REM BETTA BASIC
POKE 16419,1
NEW LINE
```

You should now have

```
1 REM BETTA BASIC
```

on the screen. Anything else means that you have probably done something wrong and it is best to start again.

If all is well then enter the hex-loader program 1, ignoring line 0 as this should already be in memory. Type Run N/L then enter the start address for the machine code data, which will be 16514 if you are just starting or another number if you are continuing from another day or after saving partly completed data. You can now enter the hexadecimal data, as many of the numbers as you like before pressing Newline, but remembering not to enter any of the spaces. There is a check-sum number after each line of data which you can compare with the check-sum number on the screen, if it is different then press S N/L and you can enter the line that is wrong. By pressing Q N/L, you can break out of the program to save it.

Looking through data

Program 2 is for looking through the data for any that is wrong. To use it, type Run 200 then enter the start address. Type Cont after each screenfull.

If all the data is entered and correct, then delete lines 5 onwards and enter program 3. Do not use New to delete the lines. The program is now finished and ready to use, unless some bugs have escaped detection.

You must have Betta Basic present in the computer before you start typing in your program. In this way the machine code routines are saved as you save your program that uses them. Now, whenever you type Run, the variables are initialised ready for use.

INT: Switches on the interrupt routine by Rand USR Int to give the following features:

TRACE ON by POKE TRN, 1 or pressing N/L and 1 together;

MEMORY ON by POKE TRN, 2 or pressing N/L and 5;

MEM/TRACE OFF by POKE TRN, 0 or pressing N/L and 2;

ROUTINE OFF by pressing N/L and 3 or Fast then Slow;

Break out of any program — even machine code — by pressing N/L and 4. This also switches routine off;

TRACE SPEED by POKE LEN, n where n is the length of the pause at each interrupt. Initially 3;

USER ROUTINE: Three bytes — USE, USE + 1 and USE + 2 — are set aside to add to call to your own interrupt driven routine. Initially all are NOPS. Make sure the routine is Off by using Fast followed by Slow before you start Poking or a crash will occur as soon as you Poke in the first number.

When using the trace or memory left

(continued on next page)

Program 1.

```
   1 REM 000000 ETC....
   5 SCROLL
   8 SCROLL
  10 PRINT AT 18,0;"START ADDRES
S?"
  15 LET A$=""
  20 INPUT S
  30 FOR X=S TO 17795 STEP 7
  40 SCROLL
  50 PRINT AT 19,0;X;
  55 LET C=0
  60 FOR T=X TO X+6
  70 IF A$="" THEN INPUT A$
  80 IF A$="S" THEN RUN
  84 IF A$="Q" THEN STOP
  86 IF LEN A$/2<>INT (LEN A$/2)
THEN LET A$=""
  88 IF A$="" THEN GOTO 70
  90 LET N=16*CODE A$+CODE A$(2)
-476
 100 POKE T,N
 110 LET C=C+N
 120 PRINT " ";A$( TO 2);
 125 LET A$=A$(3 TO )
 130 NEXT T
 140 PRINT ", ";C
 150 NEXT X
```

(continued from previous page)

features, the number will take up the first five characters in the top left corner of the screen. These numbers are only printed up during the interrupt and the original text or graphics are put back into the screen before control is handed back to the ROM. So as far as the ROM is concerned, the numbers do not even exist on the screen and so will not be "in the way". But it is important not to use the Sinclair scroll command as this will cause a crash after 23 scrolls.

Pressing N/L and 4 will break out of any machine code programs as long as the routine is switched on by Rand USR Int.

The Trace and Memory Left routines will automatically switch off when program execution ends or any error occurs, though they can operate in command mode by using N/L and the function keys 1 to 5.

The interrupt routine will be switched off by any of the following: Fast, Copy, LPrint, LList, Save, Load, Pause, New or by entering a line. If any of these are used then do not forget to switch on again by using Rand USR Int before using Trace or Memory Left.

LOC: This moves VARS up to Eline so that all the variables temporarily disappear and "load variables" can be used instead, i.e., variable names can be used for a second time without altering any or the original variables or values eg.,

VAR: Restores original variables after using LOC. Do not use unless LOC has been used first. For example

RAND USR VAR.

SCL: Stands for Scroll. Do not use the scroll provided by Sinclair as it will cause some of the routines to crash. For example:

RAND USR SCL.

In the following, X and Y can be any numberical argument in the range 0 to 65535, V any numerical variable, 1 any numerical dummy variable that is not used for anything else, anything surrounded by [] is optional, all Print statements will be changed to Rem by the routine, and should be changed back to Print if ever the line is edited. The Print lines after the USR lines hold the arguments for each routine.

ERROR CODES.

- Z variable not found, eg., R$ in Rep. Proc name etc
- 4 out of memory
- R integer out of range, ie a number less than 0 or greater than 65535 has been used in a routine
- C number error, ie a number or expression has been left out or does not make sense so the computer can not change it to an integer for it to use.
- D break
- Q missing ;
- R too many repeats (max 17)
- S syntax error, eg no data or expressions
- T missing
- U until without repeat
- V R$ error eg., R$ has been DIMed or is too short so that Rep and Unt can not use it.
- W Rand too high for LST
- X Proc name error, eg too short (minimum three characters or non-existant
- Y incorrect string variable in line after DYN

Function has three uses

PRT: This has three uses, two of which are concerned with the ports.

a) OUT (port), byte. For example:

```
10 LET I = USR PRT
20 PRINT X, Y [; X, Y . . . ]
```

b) IN variable, (port) or LET variable = IN (port). For example:

```
10 LET I = USR PRT
20 PRINT; X where X = port 0 to 255
```

c) LD I, X. For example:

```
10 LET I = USR PRT
20 PRINT; X where X = char set 0 to 255
```

This one changes the character set and can be used for games or with a graphics ROM — initially 30.

REP: Same as BBC Basic Repeat. The line numbers are stored in RS. Up to 15 Repeats can be nested — inside each other — before an error occurs. For example:

```
10 LET I = USR REP
```

UNT: BBC Basic Until. Jumps back to line after last Rep. If a testable condition is not true. For example.

```
10 LET I = USR UNT
20 PRINT testable condition
```

ONG: Same as On . . . Go To . . . Jumps to the Xth line number in a list of numbers. If X = 0 or X > number of numbers in list then the line after the ONG is executed. For example:

```
10 LET I = USR ONG
20 PRINT X ; line [, line . . . ]
```

Up to 255 lines can be put on the list.

PRC: Def Proc. This is a simulation of procecures, using names instead of line numbers. Each 'procecure' has the following structure:

```
10 REM PROCNAME
20 Subroutine or procedure
30 RETURN
```

where Name will be the name of the procecure. PRC is called only once at the beginning of the program. For example:

```
10 LET I = USR PRC
```

The routine then searches for all the "Rem Procname"s and puts the names into the variables area with their line numbers so that a procedure can be called by:

GOSUB NAME

The name must be three or more characters long and contain only characters legal as a variable name, see page 38 of the Sinclair manual. There is no space between the Proc and the Name.

DYN: Dynamic procedure. This routine tells you whether a name held a string variable is a procedure or not so that it may be used with VAL without an error occuring. If it does not exist. eg.,

```
10 INPUT A$
20 IF USR DYN THEN GOTO VAL A$
30 REM A$
40 GOTO 10
```

The above example Gotos a procedure entered in line 10 if it exists, otherwise it waits for you to enter another. The A$ in lines 10, 20 and 30 can be changed to any other string variable.

LST This is a fast scrolling list with a few extra features. To use:

Rand line to list from Rand USR LST

In this routine you can press:

Space to break out of the routine;

Z to copy the screen to the printer;

K to "normal list" the last line on the screen in order to edit;

D to list through slowly;

(continued on page 131)

Program 2.

```
190 STOP
200 PRINT "START ADDRESS ?" ,
210 INPUT I
220 FOR X=I TO 17795 STEP 7
230 PRINT X;
240 LET C=0
250 FOR T=X TO X+6
260 LET N=PEEK T
270 LET C=C+N
280 PRINT " ";CHR$ (INT (N/16)+
 28);CHR$ (N-16*INT (N/16)+28);
290 NEXT T
300 PRINT ", ";C
310 NEXT X
```

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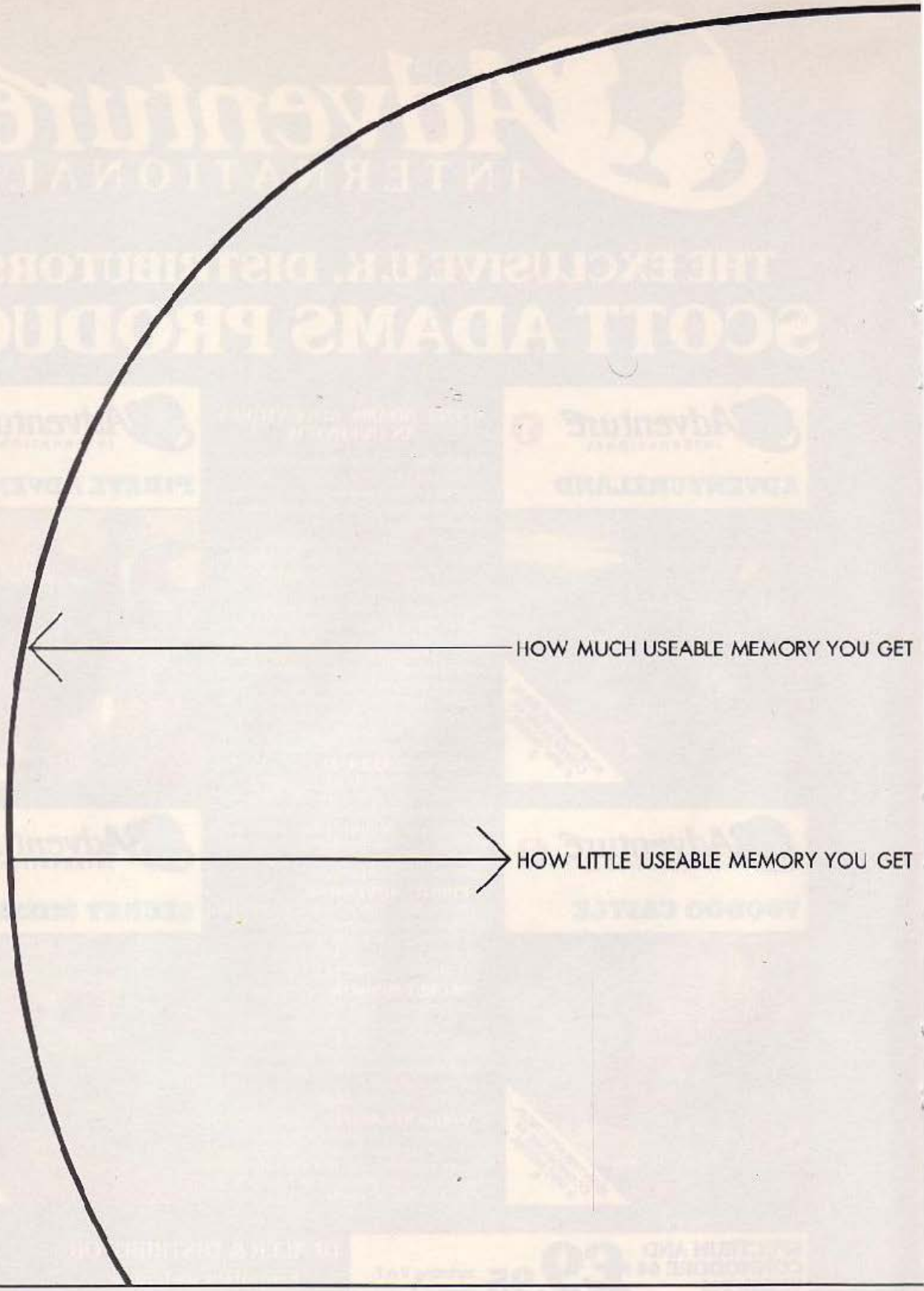


■ If you saw a computer labelled 32K, 48K or 64K you'd assume it had a large memory. Right?

Wrong. These figures bear little relationship to the actual amount of useable memory left once the computer is performing functions like text, colour, sound and even more importantly, high resolution graphics.

The Commodore, for instance, claims an "elephantine" 64K memory, yet uses up 26K producing high resolution graphics.

Under the same conditions, the Dragon 32K leaves 24K of useable memory, the Lynx 48K just 14K.

And the BBC Micro and Acorn Electron leave the operator a miserly 9K to play with.

However, there is one computer specifically designed to cope with these normal working functions as a matter of course.

The new Oric Atmos 48K.

Why, even when you add peripherals like the new micro disc drive unit and colour printer (see technical details overleaf), its useable memory is never less than a healthy 37K.

Which not only caters for all the standard applications you'd expect from any home computer, but also for advanced

WITH THE NEW ORIC ATMOS.

WITH OTHER HOME COMPUTERS.

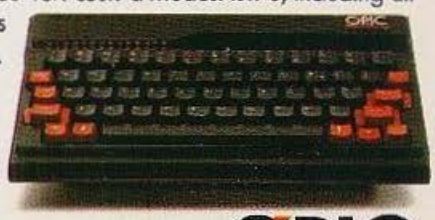
programming and very sophisticated games.

Talking of games, the new Oric Atmos starts off with a major advantage over most new computers, since it takes most of the software already written for the Oric-1.

And like the Oric-1, it has a powerful loudspeaker and amplifier inside its case.

The same unit, in fact, that prompted "Which Micro" (November) to quote... "At full volume this machine can compete with most arcade games. Its sound facilities have more in common with the £400 Beeb, than the rather pathetic beep of the Spectrum..."

Yet the Oric Atmos 48K costs a modest £170, including all the leads and adaptors you need to get it going.



But then what else would you expect from a British Company recognised for offering so much for so little?

The new Oric Atmos 48K. ØRIC

Now we've whetted your appetite, here's something to get your teeth into.

Printer Technical Specifications

Printer/ Plotting system	Ball Point Pen, 4 colour
Plotting speed: (horizontal) (vertical)	52 mm/sec (2.05ips) 73 mm/sec (3.08ips)
Printer Speed	12 characters per second
Resolution	0.2 mm/step (0.00787 inch)
Effective plotting range	96 mm (3.804 inch) x axis, divided into 480 steps (No limit in y direction)
Characters per line	80 or 40 text mode (determined by software in graphics mode)
Characters per line	INT (480/n+1) *6) for 0=n=15
Accuracy (repetition) (movement) (distance)	0.2 mm max 0.3 mm max 0.5% max (x–axis) 1% (y–axis)
Pen life	250 metres (825 feet)
Parallel interface	8–bit parallel Uses STROBE and ACKNOWLEDGE
Temperature range storage	18.3 to 35°C (65 to 96°F) –40 to 71°C (–40 to 160°F)
Humidity range	10% to 80% relative non-condensing
Power supply	Switching power supply input 100–120 VAC 200–240 VAC
Dimensions	10¾" wide 6⅞" deep 2½" high

Atmos Technical Specifications

CPU	6502 A
Memory	Choice of 16K or 48K RAM
Memory (48K Model)	Minimum 48K RAM, max 64. 16K ROM external control signals allow use of full 64K RAM or maybe used externally to increase ROM/RAM
Language	Extended Microsoft basic
Keyboard	Typewriter style and pitch, 57 keys, standard computer layout, additional cursor control keys, autorepeat facility, tactile and acoustic feedback
Display	Output for B&W or colour TV, RGB output for colour monitor.
Text format	40 line x 28 rows
Character set	Similar to Teletext format, standard ASCII double height, flashing, 80 user definable characters
Graphics	240 x 200, 8 colours
Graphic Facilities	Points, lines, circles
Sound	Internal loudspeaker and amplifier. 3-Channel sound synthesiser envelope control. amplitude control 8 octaves, noise channel
Storage	Most cassette recorders via DIN socket 300 or 2400 BAUD. Disc Drive.
Interface	Centronics, expansion port, Hi-fi, RGB Monitor, UHF TV, cassette recorder
Other	Warm reset to regain control without clearing program or data

Micro Disc Technical Specifications

Formatted Capacity	160K bytes per side (double density as standard)
No. of Tracks	40 (80 available as option at a future date)
No. of Sectors	16
Bytes per Sector	256
Transfer Rate	250K Bits/Sec

Supports up to 599 files per side, four drives single or double sided, 40 or 80 track. User definable configuration allows mixing of drive types including 5¼" (five and a quarter inch)
Extensive wild card facilities
Copy allows merging of basic and machine code files

Utilities

The Utilities are as follows:

1. Backup	Copy a whole disc
2. Copy	Copy a file to another
3. Del	Delete a file allowing wildcards
4. Dir	Display directory listing
5. Drv	Set the default drive number
6. Format	Format and initialise a disc
7. Load	Load a file (code data or basic)
8. Protect	Change protect status of file
9. Recall	Recall a basic array from a file
10. Ren	Rename a file
11. Save	Save a file (code, data or basic)
12. Store	Store a basic array as a data file
13. Sys	Change system configuration

Prices and data correct at time of going to press.
Specifications on the above models may change without notice.

Available at Dixons, Laskys, Comet, Wigfalls, Rumbelows and all good computer stockists.

ØRIC

(continued from page 126)

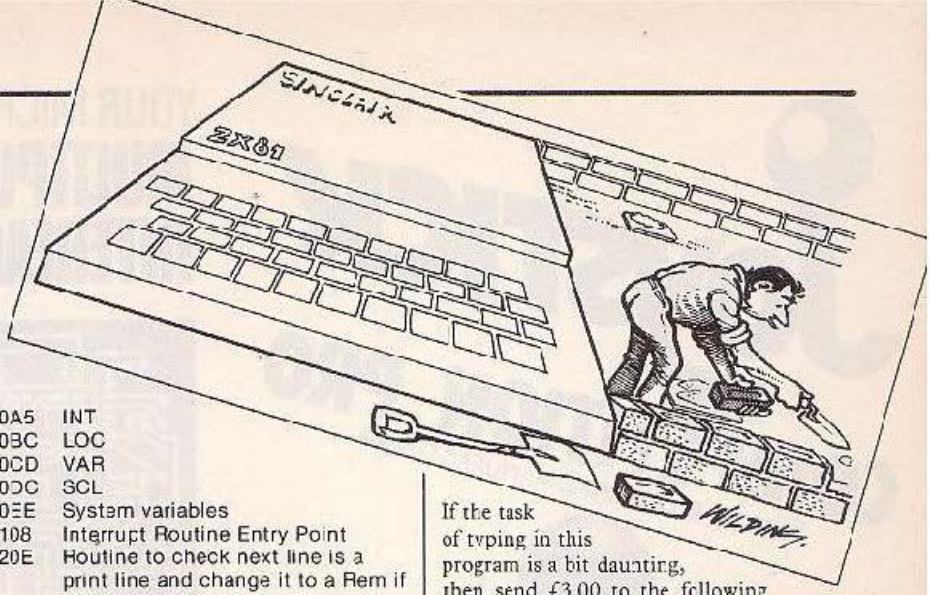
N/L to list through fast.

USEFUL ROM ROUTINES USED:

08F5h	PRINT AT B,C;	
0808h	PRINT CHR$(A);	Chars 0-63 and their inverses
094Bh	PRINT CHR$(A);	Chars 64-127 and 192-255
0A98h	PRINT BC;	
0AZAh	CLS	
063Eh	LIST	Same a pressing Newline
0369h	COPY	
1520h	STK BC	Puts BC on calc stack as "floating point" number
0EA7h	UNSTK BC	Takes BC off calc. stack
111Ch	LOOKVARS	Finds variable pointed to by CH-ADD and puts its address into HL

If you wish to disassemble the routines, then here are the addresses you will need in hexadecimal:

40A5	INT			
40BC	LOC			
40CD	VAR			
40DC	SCL			
40EE	System variables			
4108	Interrupt Routine Entry Point			
420E	Routine to check next line is a print line and change it to a Rem if necessary.			
4227	PRT	436Z	DYN	
4270	REP	43EE	PRC	
428A	UNT	44A6	LST	
430D	ONG	4585	last address	



If the task of typing in this program is a bit daunting, then send £3.00 to the following address and I will send you a copy of the finished program on tape: J D Judge, 147 Hesters Way Road, Cheltenham, Gloucestershire, GL51 0SD.

Hex dump and checksums

```
0 REM
3 REM [redacted]
      (C) J.JUDGE 1983
10 LET R$="  "
11 LET INT=16516
12 LET LOC=16519
13 LET VAR=16522
14 LET SCL=16525
15 LET PRT=16528
17 LET REP=16531
18 LET UNT=16534
19 LET ONG=16537
20 LET DYN=16540
21 LET PRC=16543
22 LET LST=16546
23 LET LEN=16552
24 LET TAN=16553
25 LET USE=16576
```

Program 3.

```
16514 76 75 C3 A5 40 03 3C. 1041
16521 40 03 CD 48 03 DC 40. 1007
16528 03 27 48 C9 75 48 03. 881
16535 8A 48 03 0D 43 03 52. 830
16542 43 03 EE 41 03 A6 44. 1006
16549 21 38 40 CB F5 CD 37. 817
16556 02 32 00 32 F5 40 21. 457
16563 F9 40 36 00 DD 21 05. 599
16570 41 C9 2A 10 40 22 01. 423
16577 41 2A 14 40 22 03 41. 280
16584 2B 22 10 40 C9 2A 01. 401
16591 41 22 10 40 2A 03 41. 439
16598 22 14 40 2B 35 50 2A. 335
16605 0C 40 E5 11 21 00 19. 380
16612 01 01 D6 00 ED B0 01. 840
16619 00 00 C9 FE FF 00 00. 740
16626 00 00 00 01 01 02. 4
16633 05 00 47 00 00 00 00. 73
16640 00 00 00 00 00 37 00. 55
16647 76 ED 5F 01 01 19 3E. 606
16654 F5 CD 85 08 CD 92 02. 836
16661 CD 20 02 CD 21 08 41. 566
16668 3A F6 40 FE 00 28 0D. 575
16675 03 A4 02 00 00 21. 394
16682 F6 40 36 00 18 F3 21. 664
16689 F6 40 36 01 2A 07 40. 475
16696 22 EF 40 2A 25 40 7D. 604
16703 FE 57 20 06 7C FE ED. 1124
16710 28 42 FE F8 28 4F FE. 997
16717 DD 20 05 21 F9 40 36. 555
16724 02 FE FD 20 07 21 F9. 505
16731 40 36 00 18 DC FD. 847
16738 20 05 21 F9 40 36 01. 435
16745 3A 00 40 FE FF 20 E9. 696
16752 3A F9 40 FE 00 28 AF. 640
16759 FE 01 28 26 FE 02 28. 520
16766 02 18 A5 2A 02 40 ED. 535
16773 5B 10 40 AF ED 52 22. 714
16780 EE 40 3E 02 32 F9 40. 729
16787 18 8C DC 21 81 02 CF. 628
16794 1A DC 21 81 02 18 82. 555
16801 01 05 00 2A 0C 40 23. 152
16808 11 FC 40 ED B0 2A 0C. 800
16815 40 23 22 FA 40 2A EE. 787
16822 40 11 FC D8 CD F8 41. 1030
16829 11 18 FC CD F8 41 11. 523
16836 9C FF CD F8 41 11 F6. 1152
16843 FF CD F8 41 11 FF FF. 1300
16850 CD F8 41 11 00 01 3A. 594
16857 F9 40 FE 00 28 04 ED. 850
16864 5B F7 40 18 7A B3 20. 752
16871 55 01 0E 00 ED 5B 0C. 597
16878 40 13 21 FC 40 ED B0. 845
16885 03 26 41 CD 19 3C 38. 814
16892 7C ED 52 C5 1B CB 87. 1182
16899 55 2A FE 40 77 23 22. 773
16906 FA 40 E1 C9 2A 29 40. 687
16913 23 23 23 23 7E FE EA. 754
16920 38 06 FE F3 28 02 CF. 794
16927 18 36 EB 23 22 16 40. 470
16934 39 2A 16 40 E5 CD 0E. 777
16941 42 DF FE 19 28 47 CD. 854
16948 B5 0F CD A7 0E C5 DF. 906
16955 FE 1A 28 02 CF 10 E7. 788
16962 CD 55 0F CD A7 0E 79. 812
16969 C1 ED 79 DF FE 19 28. 1093
16976 05 E1 22 16 40 C9 E7. 782
16983 18 DA DF FE 19 28 10. 800
16990 CD 55 0F CD A7 0E ED. 928
16997 73 0E 00 4F E1 22 16. 485
17004 40 C9 E7 CD 55 0F CD. 1206
17011 A7 0E 79 ED 47 16 BF. 575
17018 E7 18 DC 2A 16 40 E5. 532
17025 21 05 41 22 16 40 CD. 428
17032 10 11 E3 22 16 40 E1. 617
17039 7E FE 87 18 02 CF 18. 746
17046 23 5E 23 56 23 78 FE. 669
17053 22 38 F4 5E 16 00 7E. 573
17060 FE 18 38 02 CF 1A 3C. 635
17067 30 27 18 28 F5 9A 22. 881
17074 40 54 5D E1 73 23 72. 730
17081 C9 2A 15 40 E5 CD 0E. 777
17088 42 CD 55 0F CD A7 0E. 787
17095 79 E4 20 02 18 02 3E. 419
17102 01 F5 21 C5 41 22 16. 405
17109 40 CD 10 11 F1 E3 22. 816
17116 16 40 E1 F5 7E FE 57. 1020
17123 20 AF 23 5E 16 00 20. 393
17130 23 7D FE 22 38 A4 5E. 760
17137 78 FE 02 20 02 CF 1D. 847
17144 F1 FE 01 28 29 19 58. 558
17151 2B 5E 55 2B 29 40 CD. 712
17158 7E 00 55 CD 5B 77 CD. 852
17165 2A 16 40 E5 CD 0E 42. 642
17172 CD 55 0F CD A7 0E 78. 811
17179 FE 00 20 2E 79 FE 00. 707
17186 28 22 32 F5 10 0F FE. 917
17193 19 28 02 CF 19 3E 00. 361
17200 32 F4 40 E7 CD 55 0F. 894
17207 CD A7 0E 3A F4 40 3C. 811
17214 32 F4 40 E7 3A F5 40. 824
17221 BC 23 10 0F FE 1A 28. 787
17228 E6 E1 22 16 40 06 00. 583
17235 3A F5 40 4F C9 50 59. 345
17242 CD D5 09 22 29 40 18. 556
17249 E5 2A 16 40 E5 2A 29. 875
17256 40 23 23 23 23 7E FE. 564
17263 EA 20 18 23 7E FE 76. 520
17270 28 12 CB 8E CB B6 CB. 1030
17277 8E 23 7E FE 0D 20 00. 704
17284 23 7E FE 76 28 02 CF. 782
17291 20 28 28 22 16 40 CD. 440
17298 10 11 CB 7E 20 03 C8. 517
17305 76 23 94 CB 6E 28 02. 514
17312 CF 23 23 4E 23 46 78. 573
17319 B1 28 05 E5 21 20 00. 521
17326 AF ED 42 E1 30 06 01. 780
17333 00 00 E1 22 16 40 C9. 545
17340 23 11 3C 40 ED B0 13. 503
17347 3E 76 12 21 3C 40 CB. 558
17354 BE C3 B6 CB BE 7E D6. 1335
17361 26 33 E0 22 16 40 CD. 543
17368 10 11 CB 7E 28 06 C8. 534
17375 76 20 D2 18 6E 28 06. 919
17382 01 01 00 E1 22 16 40. 647
17389 C9 21 7D 40 18 20 2A. 501
17396 78 40 ED 4B F0 40 09. 807
17403 23 23 23 23 22 78 40. 356
17410 7E FE 20 D0 47 23 4E. 618
17417 ED 43 07 40 23 4E 23. 523
17424 46 23 ED 43 F0 40 7E. 639
17431 FE EA 20 D8 23 7E FE. 1151
17438 35 50 C2 23 23 23 7E. 525
17445 FE 23 20 CA 23 7E FE. 943
17452 76 CA 84 43 CB 5E CB. 1165
17459 B6 CB EE 22 F2 40 3E. 1025
17466 78 23 BE 28 06 78 BE. 785
17473 CB B6 18 F6 2B CB FE. 1155
17480 CB B6 ED 5B F2 40 AF. 1194
17487 ED 52 CA 8A 43 2B 7C. 890
17494 B5 CA 8A 43 23 E5 ED. 1039
17501 5B 14 40 18 D6 23 23. 455
17508 23 23 23 23 44 4D EB. 520
17515 09 EB 23 23 23 4E ED. 558
17522 72 36 02 CF 03 E1 36. 551
17529 30 20 22 14 40 23 06. 534
17536 FE 22 1A 40 22 10 40. 504
17543 D1 C1 03 2A F2 40 ED. 450
17550 B0 ED 4B 07 40 D5 CD. 977
17557 20 15 EF 00 34 D1 01. 740
17564 05 00 2A 5D 40 ED B0. 606
17571 03 F3 43 01 00 14 CD. 731
17578 F5 08 2A 32 40 01 0F. 425
17585 27 EF ED 42 38 02 C5. 782
17592 1F 2A 32 40 CD D8 09. 617
17599 28 E3 E5 3E 00 D7 E1. 608
17606 46 23 4E 23 23 E5 ED. 719
17613 43 3E 40 CD 88 0A F1. 785
17620 23 E5 CD 8B 02 E5 C1. 1080
17627 51 14 3E 00 20 F5 CD. 653
17634 8D 07 7E FE 00 28 03. 664
17641 FE 3F 20 05 CD 69 05. 579
17648 18 E4 FE 20 20 04 11. 505
17655 00 06 18 7A B3 20 F8. 617
17662 18 18 FE 30 20 17 E1. 833
17669 2A 3E 40 CD D8 09 18. 556
17676 23 4E ED 43 0A 40 5D. 726
17683 43 23 40 CD 3E 06 CD. 646
17690 0C E1 E5 ED 4B 0C 40. 954
17697 AF ED 42 30 F3 E1 7E. 1122
17704 FE 76 20 07 BB 2E 76. 800
17711 D7 E1 18 23 FE 7E 40. 911
17718 03 23 23 23 23 23 23. 816
17725 18 E8 E5 7E CB 76 28. 972
17732 3E CD 18 30 18 01 5F. 633
17739 3A 3A 40 E1 FE 03 28. 702
17746 03 C3 D4 11 E5 2A 0C. 751
17753 40 E5 11 21 00 19 D1. 577
17760 01 D6 00 ED B0 2A 0E. 986
17767 40 AF 11 21 00 ED 52. 808
17774 22 0E 40 3A 3A 40 3C. 352
17781 32 3A 40 E1 7E FE 76. 895
17788 CA C0 44 C3 D4 44 C3. 1132
```

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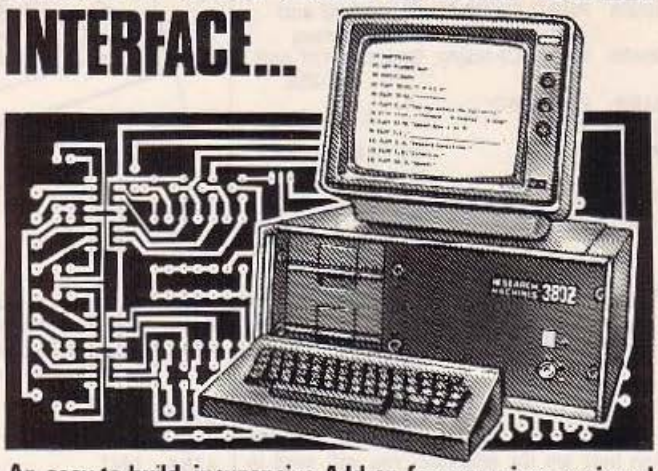

An easy-to-build, inexpensive Add-on for any micro equipped with a parallel Printer Port or User Port (with + 5V supply).

This unit provides eight independently controllable power switches under software management. The article contains full, easy-to-follow constructional and testing details. There are software examples for the RM380Z and VIC-20 Microcomputers for controlling model train speed and direction.

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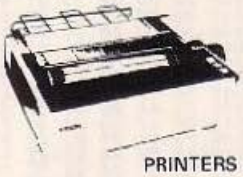

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LABYRINTH

Enter the depths with Paul Hadler and his Vic-20.

THIS PROGRAM WAS inspired by a program I had a game of one dark and chilly winter evening last year. The aim of that game was to make your way through a plan of a maze randomly chosen by the computer in as short a time as possible. Points were awarded for speed and agility around the maze. This led me to start work on a game which would be displayed in three dimensions visually on the screen so as to give the impression of actually walking the corridors of the labyrinth. It would also have extra features to help a hopelessly lost computer games addict reach the exit.

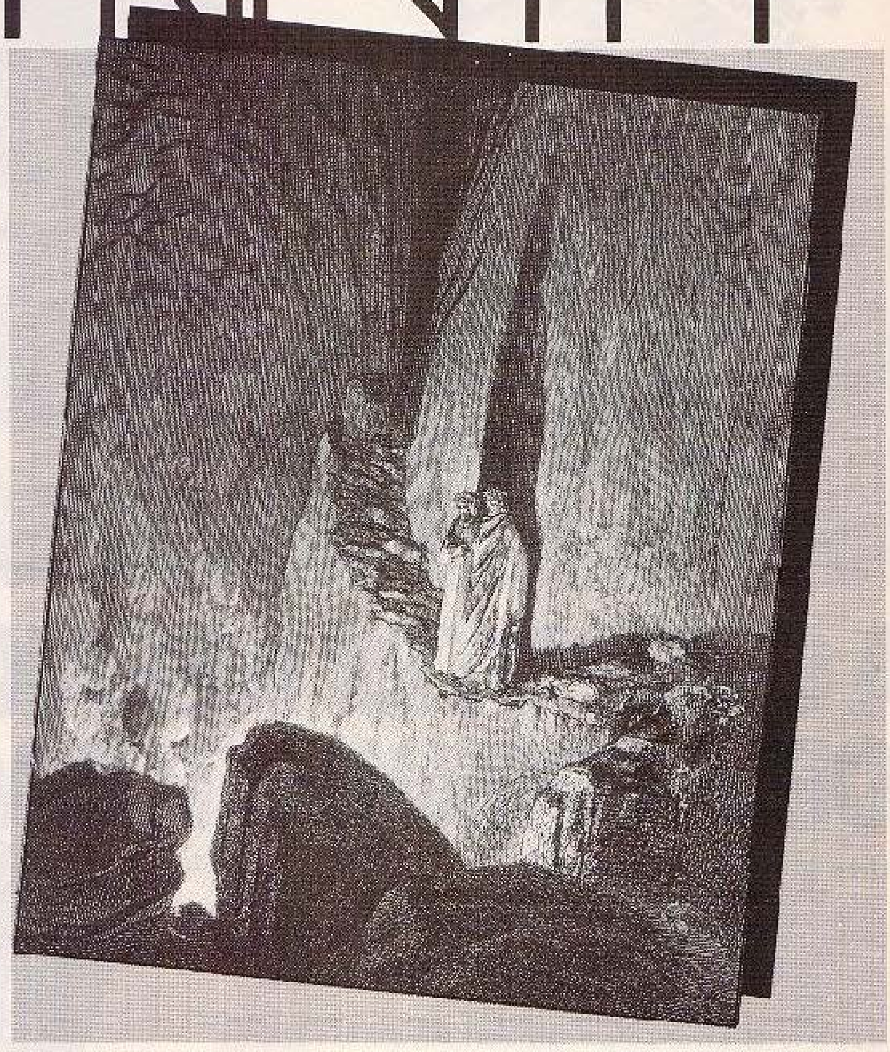
The program itself runs on a Vic-20 with 16K memory expansion and I must say takes a fair old time to load from the faithful cassette unit of the Vic-20.

As with some other programs, there are no fuss and bother items before loading the program with Peeks and Pokes or anything else for that matter. Just simply run the program once loaded into the computer and let it do the work.

Once loaded and run the program will ask for vertical and horizontal dimensions of the maze, the maximum sizes of which are 18 by 18 cells. The computer will then build the maze starting with a random entry point in the south wall. On completion of the maze build the user is then required to state if he or she would like to see a two dimensional view of the maze.

The program then draws up on the screen a

(continued on page 135)



```
10 REM*****************
12 REM*               *
20 REM*  LABYRINTH    *
30 REM*               *
40 REM* BY P.HANLFR   *
50 REM*               *
60 REM*****************
70 REM
80 REM
90 REM
100 POKE36879,8:PRINT"■"
1.0 PRINT"■■■■     ■              ■"
1.5 PRINT"         ■ LABYRINTH ■"
120 PRINT"         ■           ■"
125 FORT=1TO1000:NEXT
130 PRINT"■■              BY"
135 PRINT"■■        PAUL HAILER"
140 FORT=1TO3000:NEXT
200 REM*SIZE OF MAZE*
2.0 REM
220 INPUT"■VERTICAL LENGTH■■■■■■■";V
230 INPUT"■HORIZ. LENGTH■■■■■■■";H
240 IFV>INT(V:ORV<1ORV>18GOTO250
250 IFH=INT(H:ANDH>0ANDH<19GOTJ290
260 PRINT"■■■MAX. MAZE SIZE 19 X 12":FORY=1TO1200:NEXT
280 GOTO220
290 PRINT"■PLEASE WAIT WHILE MAZE":PRINT"IS BUILT."
300 REM**BUILD MAZE**
310 REM
331 Y=0:X=0:I=0:KF=0:C=2:RV=0:IX=0:NF=2:EF=0:SF=0:WF=0:D=0:WO=2:A=0:B=0:AQ=2
332 B0=0:P=0:W=0:S=0:E=0:N=0:L=0:F=0:R=0:N0=0:EQ=0:SQ=0:WQ=0:ZC=0:C=0:CM=0
333 Z=0:T=0:L0=0:F0=0:R0=0:M=0:CF=0:J=0:XY=0:ZZ=0
340 DIMP(H,V),Q(H,V),C(H*V,2)
345 P(0,0)=0:FORY=1TOV:P(0,Y)=2:NEXTY
350 FORX=1TOH:P(X,0)=1:FORY=1TOV:P(X,Y)=3:NEXTY,X
380 CL$="              ■■■■■■■■■■■■■"
390 PS$="■■"
400 REM*RND ENTRY POINT*
4.0 REM**IN SOUTH WALL**
420 REM
430 RV=INT(H*RND(0))+1
440 IX=RV:X=IX:Y=1:Q(X,Y)=1:P(X,0)=0
500 REM*FIND ALLOWED DIRECTION FOR NEXT MOVE*
520 REM
530 NF=0:IFY<VTHENIFQ(X,Y+1)=0THENNF=1
540 IFY=VANDKF=0THENNF=1
550 EF=0:IFX<HTHENIFQ(X+1,Y)=0THENEF=1
560 SF=0:IFY>1THENIFQ(X,Y-1)=0THENSF=1
570 WF=0:IFX>1THENIFQ(X-1,Y)=0THENWF=1
600 REM*CHOOSE DIRECTION OF MOTION*
610 REM
620 RV=INT((NF+EF+SF+WF)*RND(1))+1
630 D=8*NF+4*EF+2*SF+WF
640 IFD=0GOTO1520:REM*DEAD END/FIND START OF NEXT BUILD*
650 ONDGOTO1320,,1220,700,1120,710,720,730,900,740,750,760,770,780,790
700 ONRVGOTO1220,1320
710 ONRVGOTO1120,1320
720 ONRVGOTO1120,1220
730 ONRVGOTO1120,1220,1320
740 ONRVGOTO920,,320
750 ONRVGOTO920,,220
760 ONRVGOTO920,,220,1320
770 ONRVGOTO920,,120
780 ONRVGOTO920,,120,1320
790 ONRVGOTO920,,120,1220
900 REM**MOVE NORTH**
910 REM
920 IFY=VGOTO1020:REM*MAKE EXIT IN NORTH WALL*
930 Y=Y+1
940 Q(X,Y)=C
950 IFP(X,Y-1)=3THENP(X,Y-1)=2:GOTO1430
960 P(X,Y-1)=0:GOTO1430
1000 REM**MAKE EXIT IN NORTH WALL**
1010 REM
1020 KF=1:WO=X
1030 IFP(X,Y)=3THENP(X,Y)=2:GOTO1520:REM*FIND START OF NEXT BUILD*
1040 P(X,Y)=0:GOTO1520
1100 REM**MOVE EAST**
1110 REM
1120 X=X+1
1130 Q(X,Y)=C
1140 IFP(X-1,Y)=3THENP(X-1,Y)=1:GOTO1430
1150 P(X-1,Y)=0:GOTO1430
1200 REM**MOVE SOUTH**
1210 REM
1220 Y=Y-1
1230 Q(X,Y)=C
1240 P(X,Y)=2
1250 GOTO1430
1300 REM**MOVE WEST**
1310 REM
1320 X=X-1
1330 Q(X,Y)=C
1340 P(X,Y)=1
1400 REM*BUILD COMPLETE*
1410 REM*IF SO MAKE EXIT IF NECESSARY*
```

(listing continued on page 135)

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serial number/s .....

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Please note that if you are applying for warranty under scheme A or B, please enclose the original manufacturer's warranty. It will be returned with your MicroCare warranty.

(continued from page 133)

three dimensional representation of the maze of whichever way you are facing to the maze. You then proceed into and around the maze to hopefully search for the way out.

To manouvre yourself around the maze use the following control keys:

L — Left turn; R — Right turn; F — Forward; A — About turn.

If you should find your quest for the exit is not progressing as fast as you would like there is another command which has been incorporated into the program for your assistance. This command is called Help and is further subdivided into commands which will tell you certain information about the maze. But, before a description of each command is given a word in your ear. In this command — Help — a truthful account of your position and general status is not always given, so beware, or you would be led up the garden path. Sorry.

The help commands are H followed by:

X — This may give you your current position in the maze.

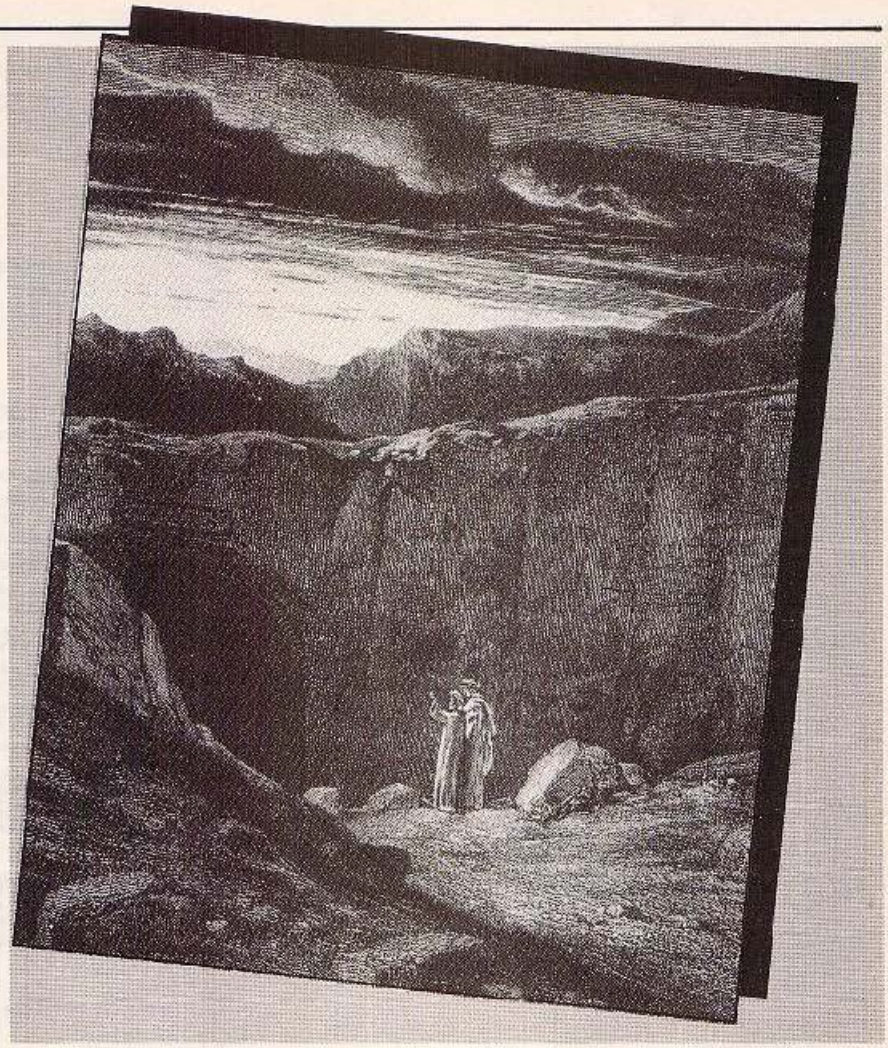
D — This gives you a distance in moves to the exit.

S — For a suggested next move — very dodgy.

At this point I would like to point out that a wrong move — or suggested wrong move — may cause you to fall out of the maze if lurking around the start position in the maze; so be careful. And finally:

? — For a plan of the maze.

To get out of the Help routine and back to the maze display type I.



Lines

100-290	Begin the maze build.
400-440	Random entry point in south wall.
500-570	Find allowed direction for next move.
600-790	Choose direction of motion.
900-960	Move north.
1000-1040	Make exit in north wall.
1100-1150	Move east.
1200-1250	Move south.
1300-1340	Move west.
1400-1470	If build complete make exit if necessary. Put player at start position.
1500-1560	Begin new maze build.
1600-2190	Code complete information about each cell in array P(X,Y).
2200-2290	Determine direction through maze.
2600-2820	Display depth 1.
3000-3220	Display depth 2.
3400-3620	Display depth 3.
3800-4020	Display depth 4.
5000-6690	Accept commands and execute end games.
6800-6870	Another game.
6900-6960	Index to next cell.
7000-7280	Calculate L, R and F.
7300-7460	Subroutines.
7500-7610	Determine direction of next move.

(listing continued from page 133)

```
1420 REM
1430 IFC<H*V THENC=C+1:GOTO530 REM*NEXT MOVE*
1440 IFX=H*V GOTO1450 REM*EXIT MADE*
1450 X=INT(H*RND(1))+1:V=V*P(X,V)=P(X,V)-1:WO=X
1460 X=1:Y=0:Z=1:REM*PUT PLAYER IN START POSITION*
1470 GOTO1620
1500 REM*FIND START OF NEXT BUILD*
1510 REM
1520 IFX<H THENK=K+1:GOTO1550
1530 IFY<V THENY=Y+1:X=1:GOTO1550
1540 X=1:Y=1
1550 IFP(X,Y)=0GOTO 1520
1560 GOTO530
1600 REM* IS PLAN REQUIRED*
1610 REM
1620 PRINT"THE MAZE HAS NOW  BEEN":PRINT"BUILT. WOULD  YOU LIKE":PRINT"TO SEE A
 PLAN"
1630 PRINT"** Y=YES AND N=NO"
1660 GET$
1670 IFA$="Y"THENGOTO1695
1680 IFA$="N"THENGOTO1900
1690 GOTO1660
1695 REM*PRINT PLAN OF MAZE*
1697 REM
1700 PRINT"DON";
1710 FORJ=VTO0STEP-1
1730 FORI=0TOH
1735 P=P(I,J)-4*INT(P(I,J)/4)
1740 IFP=0THENPRINT"  ";
1750 IFP=1THENPRINT"_";
1760 IFP=2THENPRINT" |";
1770 IFP=3THENPRINT"_|";
1780 IFP=4THENPRINT"|
1790 NEXTI,J
1800 XY=4096+22*(2+V-J)+X
1802 IFZ=1THENZZ=158
1804 IFZ=2THENZZ=190
1806 IFZ=3THENZZ=159
1808 IFZ=4THENZZ=188
1810 P=PEEK(XY)
1820 FORI=1TO10
1830 POKEXY,ZZ:FORJ=1TO100:NEXT:POKEXY,P:FORJ=1TO100:NEXT
1840 NEXT
1850 IFA$="P"GOTO2400
1860 POKEXY,30
1870 PRINT"**PLEASE WAIT**"
1900 REM**PRINT INSTRUCTIONS**
1910 REM
2100 REM*CODE COMPLETE INFORMATION*
2110 REM*ABOUT EACH CELL*
2120 REM*IN ARRAY P(X,Y)*
2130 REM
2140 FORI=1TOH:FORJ=1TOV
2160 IFINT(P(I-1,J)/4-INT(P(I-1,J)/4)+.5)=1THENP(I,J)=P(I,J)+8
2180 IFP(I,J-1)/2-INT(P(I,J-1)/2)=.5THENP(I,J)=P(I,J)+4
2190 NEXTJ,I
2200 REM**DETERMINE OPTIMAL ROUTE**
2210 REM**THROUGH MAZE**
2220 REM
2230 C(0,1)=WO:C(0,2)=V-1:I=1:A=WO:B=V:GOTO2270
2240 I=I+1
2280 GOSUB7520:REM*OPTIMAL DIRECTION*
2260 GOSUB6920:REM*INDEX TO NEXT CELL*
2270 C(I,1)=A:C(I,2)=B
2280 IF0(A,B)>1GOTO2240
2290 CM=I
2400 REM**PRINT PERSPECTIVE VIEW**
2410 REM
2420 PRINT"D";
2430 A=X:B=Y
2440 FORT=1TO4
2450 GOSUB7020:REM*EVALUATE L,F & R*
2460 IFF=-2GOTO2510
2470 ONTGOSUB2620,3020,3420,3820
2480 IFF=1GOTO2510
2490 ZC=Z:GOSUB6920:REM*INDEX TO NEXT CELL*
2500 NEXT
2510 GOTO5890:REM*ACCEPT INSTRUCTIONS*
2600 REM**DISPLAY DEPTH 1**
2610 REM
2620 IFL=2CR(L=-1ANDZ=3)GOTO2640
2630 FORI=1TO17:POKE4163+22*I,103:NEXT
2640 IFR=2CR(R=-1ANDZ=3)GOTO2660
2650 FORI=1TO17:POKE4181+22*I,101:NEXT
2660 ON(4-L)GOTO2720,2690,2670,2700,2710
2670 POKE4140,77:POKE4153,77
2680 POKE4559,79:POKE4580,79
2690 GOTO2720
2700 POKE4162,100:POKE4163,100
2710 POKE4558,99:POKE4559,99
2720 ON(4-R)GOTO2780,2740,2730,2760,2770
2730 POKE4181,79:POKE4190,79
2740 POKE4577,77:POKE4600,77
```

(listing continued on next page)

(listing continued from previous page)

```
2750 GOTO2780
2760 POKE4181,100:POKE4182,100
2770 POKE4577,99:POKE4578,99
2780 IFF<1ORF>2GOTO2820
2790 IFF=2GOTO2810
2800 FORI=1TO17:POKE4163+I,100:NEXT
2810 FORI=1TO17:POKE4559+I,99:NEXT
2820 RETURN
3000 REM**DISPLAY DEPTH 2**
3010 REM
3020 IFL=2OR(L=-1ANDZ=3)GOTO3040
3030 FORI=1TO9:POKE4255+22*I,103:NEXT
3040 IFR=2OR(R=-1ANDZ=3)GOTO3060
3050 FORI=1TO9:POKE4265+22*I,101:NEXT
3060 ON(4-L)GOTO3120,3080,3070,3100,3110
3070 POKE4166,77:POKE4200,77:POKE4232,77:POKE4255,77
3080 POKE4538,78:POKE4517,78:POKE4496,78:POKE4475,78
3090 GOTO3120
3100 POKE4252,100:POKE4253,100:POKE4254,100:POKE4255,100
3110 POKE4472,99:POKE4473,99:POKE4474,99:POKE4475,99
3120 ON(4-R)GOTO3180,3140,3130,3160,3170
3130 POKE4265,78:POKE4244,78:POKE4223,78:POKE4202,78
3140 POKE4485,77:POKE4508,77:POKE4531,77:POKE4554,77
3150 GOTO3180
3160 POKE4265,100:POKE4266,100:POKE4267,100:POKE4268,100
3170 POKE4485,99:POKE4486,99:POKE4487,99:POKE4488,99
3180 IFF<1ORF>2GOTO3220
3190 IFF=2GOTO3210
3200 FORI=1TO9:POKE4255+I,100:NEXT
3210 FORI=1TO9:POKE4475+I,99:NEXT
3220 RETURN
3400 REM**DISPLAY DEPTH 3**
3410 REM
3420 IFL=2OR(L=-1ANDZ=3)GOTO3440
3430 FORI=1TO5:POKE4301+22*I,103:NEXT
3440 IFR=2OR(R=-1ANDZ=3)GOTO3460
3450 FORI=1TO5:POKE4307+22*I,101:NEXT
3460 ON(4-L)GOTO3520,3480,3470,3500,3510
3470 POKE4278,77:POKE4301,77
3480 POKE4454,78:POKE4433,78
3490 GOTO3520
3500 POKE4300,100:POKE4301,100
3510 POKE4432,99:POKE4433,99
3520 ON(4-R)GOTO3580,3540,3530,3560,3570
3530 POKE4286,78:POKE4307,78
3540 POKE4439,77:POKE4462,77
3550 GOTO3580
3560 POKE4307,100:POKE4308,100
3570 POKE4439,99:POKE4440,99
3580 IFF<1ORF>2GOTO3620
3590 IFF=2GOTO3610
3600 FORI=1TO5:POKE4301+I,100:NEXT
3610 FORI=1TO5:POKE4433+I,99:NEXT
3620 RETURN
3800 REM**DISPLAY DEPTH 4**
3810 REM
3820 IFL=2OR(L=-1ANDZ=3)GOTO3840
3830 POKE4346,103:POKE4368,103:POKE4390,103
3840 IFR=2OR(R=-1ANDZ=3)GOTO3860
3850 POKE4350,101:POKE4372,101:POKE4394,101
3860 ON(4-L)GOTO3920,3880,3870,3900,3910
3870 POKE4324,77
3880 POKE4412,78
3890 GOTO3920
3900 POKE4324,100
3910 POKE4412,99
3920 ON(4-R)GOTO3980,3940,3930,3960,3970
3930 POKE4328,78
3940 POKE4416,77
3950 GOTO3980
3960 POKE4328,100
3970 POKE4416,99
3980 IFF<1ORF>2GOTO4020
3990 IFF=2GOTO4010
4000 POKE4325,100:POKE4326,100:POKE4327,100
4010 POKE4413,99:POKE4414,99:POKE4415,99
4020 RETURN
5000 REM**ACCEPT INSTRUCTIONS**
5010 REM
5080 PRINT"COMMAND?          ";
5090 PRINT" ";:FORI=1TO200:NEXT:PRINT"  ";:FORI=1TO200:NEXT
5100 GETA$
5110 IFA$="H"GOTO5220
5120 IFA$="L"GOTO6220
5130 IFA$="R"GOTO6320
5140 IFA$="A"GOTO6420
5150 IFA$="F"GOTO6550
5160 GOTO5090
5200 REM**HELP ROUTINE**
5210 REM
5220 PRINT"HELP":FORI=1TO500:NEXT
5230 PRINT"HELP":PRINT" D FOR DIRECTION":PRINTSPC(3);"FACED"
5240 PRINT" P FOR CURRENT":PRINTSPC(3);"POSITION"
5250 PRINT" X FOR DISTANCE":PRINTSPC(3);"TO EXIT"
5260 PRINT" S FOR SUGGESTED":PRINTSPC(3);"NEXT INSTRUCTION"
5270 PRINT" E TO EXECUTE":PRINTSPC(3);"SUGGESTION"
5275 PRINT" M FOR MAZE PLAN"
5280 PRINT" I TO END HELP":PRINT
5310 GETA$
5320 IFA$="Z"GOTO5420
5330 IFA$="X"GOTO5520
5340 IFA$="U"GOTO5615
5350 IFA$="S"GOTO5720
5360 IFA$="E"GOTO5820
5365 IFA$="P"GOTO1700
5370 IFA$="I"GOTO2420:REM*END HELP/ACCEPT FURTHER INSTRUCTIONS*
5380 GOTO5310
5400 REM*DIRECTION FACED*
5410 REM
5420 PRINT"YOU ARE FACING ";
5425 Z=1
5430 IFZ=1THENPRINT"NORTH"
5440 IFZ=2THENPRINT"EAST"
5450 IFZ=3THENPRINT"SOUTH"
5460 IFZ=4THENPRINT"WEST"
5465 FORI=1TO2000:NEXT
5470 GOTO5230
5520 PRINT"POSITION ";X;",";Y:FORI=1TO2000:NEXT
5530 GOTO5230
5600 REM**DETERMINE DIST. TO EXIT**
5610 REM
5615 PRINT"THINKING"
5620 A=X:B=Y:M=0
5630 GOSUB6020:REM*FIND OPTIMAL DIRECTION OF NEXT MOVE*
5635 IFCF=1THENM=M+J:GOTO5670
5640 GOSUB6920:REM*INDEX TO NEXT CELL*
5650 M=M+1:IFM<200GOTO5660
5655 PRINT"TOO FAR TO CALCULATE":FORI=1TO2000:NEXT:GOTO5230
5660 IFB<V+1GOTO5630
5670 PRINT"":PRINTM;" UNITS TO EXIT":FORI=1TO2000:NEXT
5680 GOTO5230
5700 REM*DETERMINE BEST NEXT INSTRUCTION*
5710 REM
5720 A=X:B=Y:GOSUB6020:REM*FIND OPTIMAL DIRECTION OF NEXT MOVE*
5730 PRINT"SUGGESTED MOVE"
5740 IFZ=ZOTHENPRINT" FORWARD"
5750 IFZ-ZO=1ORZ-ZO=-3THENPRINT" TURN LEFT"
5760 IFZ-ZO=3ORZ-ZO=-1THENPRINT" TURN RIGHT"
5770 IFABS(Z-ZO)=2THENPRINT" ABOUT TURN"
5780 FORI=1TO2000:NEXT:GOTO5230
5800 REM**EXECUTE OPTIMAL INSTRUCTION**
5810 REM
5820 A=X:B=Y:GOSUB6020:REM*FIND OPTIMAL DIRECTION OF NEXT MOVE*
5830 IFZ=ZOTHENA$="F"
5840 IFZ-ZO=1ORZ-ZO=-3THENA$="L"
5850 IFZ-ZO=3ORZ-ZO=-1THENA$="R"
5860 IFABS(Z-ZO)=2THENA$="A"
5870 PRINT"":GOTO5110
6000 REM*FIND OPTIMAL DIRECTION OF MOVE*
6010 REM
6020 IFB>0GOTO6070
6030 IFA=IXTHENZO=1
6040 IFA<IXTHENZO=2
6050 IFA>IXTHENZO=4
6060 RETURN
6070 CF=0:FORI=1TOCM
6075 RETURN
6080 IFC(I,1)<>AORC(I,2)<>BGOTO6092
6082 IFC(I-1,2)-B=1THENZO=1
6084 IFC(I-1,1)-A=1THENZO=2
6086 IFC(I-1,2)-B=-1THENZO=3
6088 IFC(I-1,1)-A=-1THENZO=4
6090 J=I:I=CM:CF=1
6092 NEXT
6094 IFCF=0THENGOSUB7520
6095 RETURN
6200 REM**TURN LEFT**
6210 REM
6220 PRINT"LEFT":FORI=1TO400:NEXT
6230 Z=Z-1:IFZ=0THENZ=4
6240 GOTO2420:REM*PRINT PERSPECTIVE VIEW*
6300 REM**TURN RIGHT**
6310 REM
6320 PRINT"RIGHT":FORI=1TO400:NEXT
6330 Z=Z+1:IFZ=5THENZ=1
6340 GOTO2420:REM*PRINT PERSPECTIVE VIEW*
6400 REM**ABOUT TURN**
6410 REM
6420 PRINT"ABOUT TURN":FORI=1TO400:NEXT
6430 Z=Z+2-4*SGN(1-SGN(Z-3))
6440 GOTO2420:REM*PRINT PERSPECTIVE VIEW*
6500 REM**MOVE FORWARD**
6510 REM**CHECK IF GAME FINISHED**
6530 REM**OR WALKING INTO WALL**
6540 REM
6550 PRINT"FORWARD":FORI=1TO400:NEXT
6560 A=X:B=Y:GOSUB7020:REM*EVALUATE L,F & R*
6570 IFF<>1GOTO6630
6580 PRINT"STRAIGHT INTO A WALL!"
6590 FORI=1TO100:POKE36865,INT(RND(1)*3+38):NEXT:POKE36865,38
6600 PRINT"                    "
6620 GOTO5080:REM*NEW INSTRUCTION*
6630 ZO=Z:GOSUB6920:REM*INDEX TO NEXT CELL*
6640 X=A:Y=B
6650 IFY>=0ANDY<=VANDX>0ANDX<=HGOTO2400:REM*PRINT PERSPECTIVE VIEW*
6655 IFY>VGOTO6690
6660 PRINT"AAAAAAAAAAAAAAARRRRGGHHH!!!"
6665 FORI=38TO25STEP-1:POKE36865,I:FORJ=1TO12:NEXT:NEXT:PRINT"":POKE36865,38
6670 PRINT"YOU'VE FALLEN OVER THE":PRINT"EDGE OF THE WORLD!!"
6680 FORI=1TO5000:NEXT:GOTO6815
6690 PRINT"WAY-OUT!":FORI=1TO2000:NEXT
6800 REM**ANOTHER GAME**
6810 REM
6815 PRINT"TYPE :-"
6820 PRINT" 1 TO TRY THE SAME":PRINT"    MAZE AGAIN"
6825 PRINT" 2 TO TRY A NEW MAZE"
6830 PRINT" 3 IF YOU DON'T WANT":PRINT"    ANOTHER GAME"
6835 PRINT"WHICH OPTION PLEASE?"
6840 GETA$
6850 IFA$="1"THENX=IX:Y=0:Z=1:GOTO2420
6855 IFA$="2"THENCLR:GOTO220
6860 IFA$="3"GOTO6870
6865 GOTO6840
6870 PRINT"":END
6900 REM**INDEX TO NEXT CELL**
6910 REM
6920 IFZO=1THENB=B+1
6930 IFZO=2THENA=A+1
6940 IFZO=3THENB=B-1
6950 IFZO=4THENA=A-1
6960 RETURN
7000 REM**EVALUATE L,F & R**
7010 REM
7020 IFB<1GOTO7051:REM*OUTSIDE MAZE TO SOUTH*
7030 IFB>VTHENF=-2:RETURN:REM*OUTSIDE MAZE TO NORTH*
7040 A0=A:B0=B:GOSUB7320
7050 GOTO7100
7051 IFZ>1GOTO7060
7052 F=1:IFA=IXTHENF=0
7053 IFA=1THENL=2
7054 IFA=IX+1THENL=3
7055 IFA>1ANDA<>IX+1THENL=1
7056 IFA=HTHENR=2
7057 IFA=IX-1THENR=3
7058 IFA<HANDA<>IX-1THENR=1
7059 RETURN
7060 W=-1:IFA<2THENW=-2:IFA=1THENW=2
7070 S=-2:IFB=0THENS=2
7080 E=-1:IFA>HTHENE=-2:IFA=HTHENE=2
7090 N=1:IFA=IXTHENN=0
7100 GOSUB7420
7110 L=L0:F=F0:R=R0
7120 IFL<>0GOTO7200
7130 IFZ=1THENA0=A-1
7140 IFZ=2THENB0=B+1
7150 IFZ=3THENA0=A+1
7160 IFZ=4THENB0=B-1
7170 GOSUB7320
7180 GOSUB7420
7190 IFF0<>1THENL=3
7200 IFR<>0THENRETURN
7210 IFZ=1THENA0=A+1
7220 IFZ=2THENB0=B-1
7230 IFZ=3THENA0=A-1
7240 IFZ=4THENB0=B+1
7250 GOSUB7320
7260 GOSUB7420
7270 IFF0<>1THENR=3
7280 RETURN
7300 REM**SUBROUTINE**
7310 REM
7320 P=P(A0,B0):N=SGN(1+SGN(P-8))
7330 P=P-8*N:S=SGN(1+SGN(P-4))
7340 P=P-4*S:E=SGN(1+SGN(P-2))
7350 P=P-2*E:W=P
7360 IFB0=1ANDA0=IXTHENS=2
7370 IFB0=VANDA0=WOTHENN=3
7380 RETURN
7400 REM**SUBROUTINE**
7410 REM
7420 IFZ=1THENL0=W:F0=N:R0=E
7430 IFZ=2THENL0=N:F0=E:R0=S
7440 IFZ=3THENL0=E:F0=S:R0=W
7450 IFZ=4THENL0=S:F0=W:R0=N
7460 RETURN
7500 REM**DETERMINE THE OPTIMAL DIRECTION OF NEXT MOVE**
7510 REM
7520 A0=A:B0=B:GOSUB7320:REM*EVALUATE N,E,S & W*
7530 NO=N*V+1:IFN=0THENNO=Q(A,B-1)
7540 EO=H*V+1:IFE=0THENEO=Q(A+1,B)
7550 SO=H*V+1:IFS=0THENSO=Q(A,B+1)
7560 WO=H*V+1:IFW=0THENWO=Q(A-1,B)
7570 ZO=1:O=NO
7580 IFEO<OTHENZO=2:O=EO
7590 IFSO<OTHENZO=3:O=SO
7600 IFWO<OTHENZO=4:Z=WO
7610 RETURN
```

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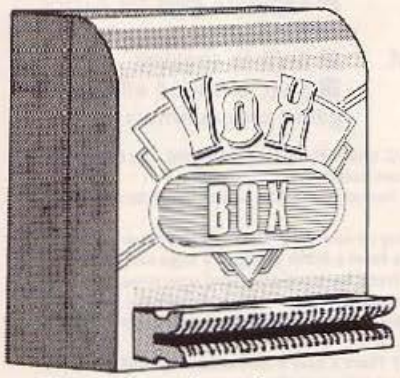

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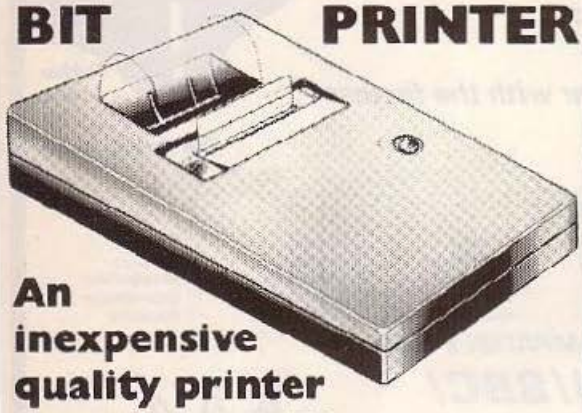

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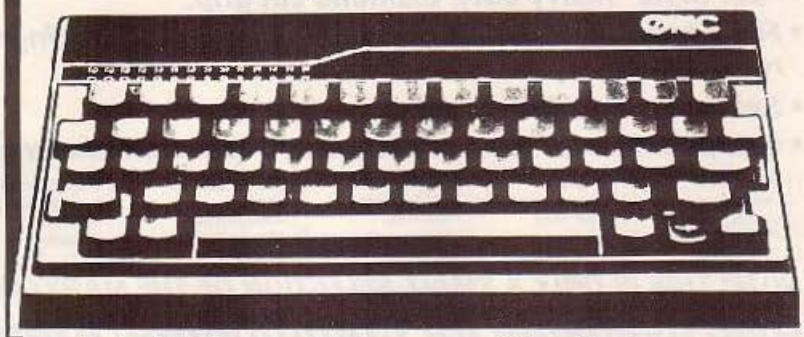

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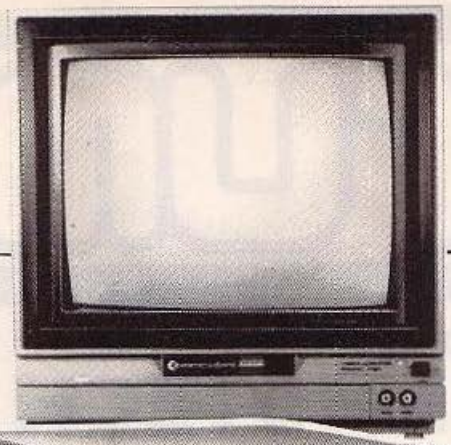

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Not all stores carry every advertised item, please phone before making a journey - prices correct at time of going to press E&OE

spectrum

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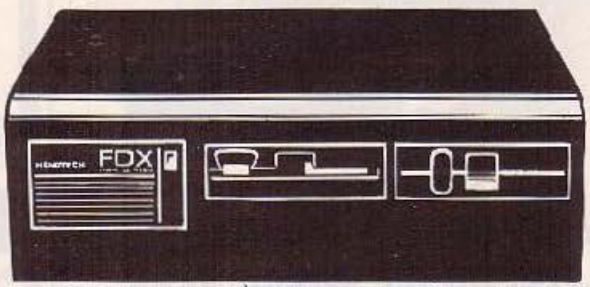

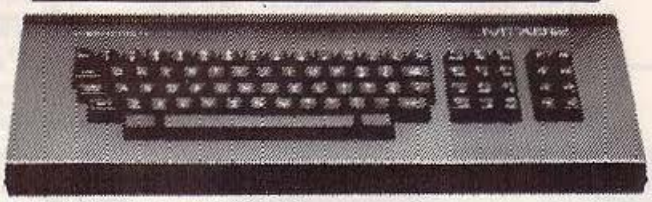

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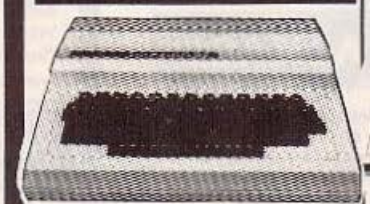

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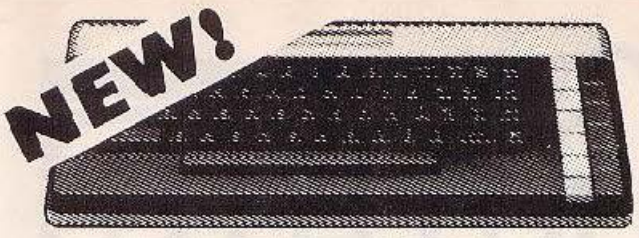

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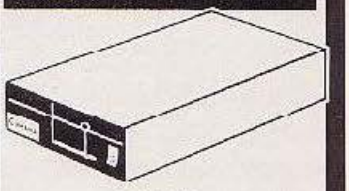

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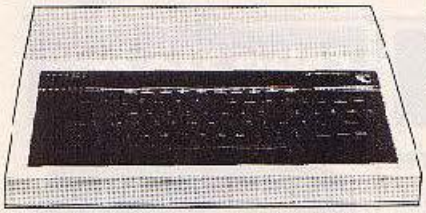

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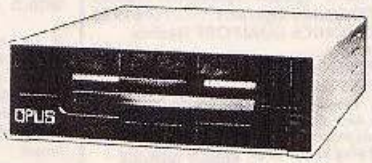

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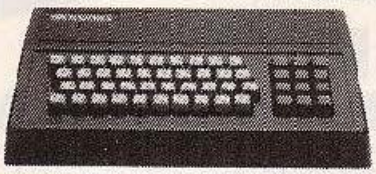

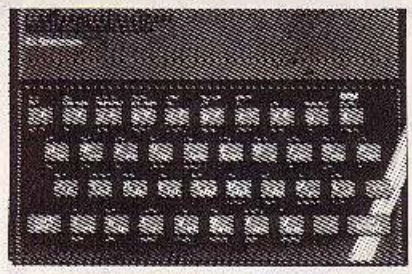

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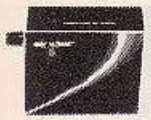

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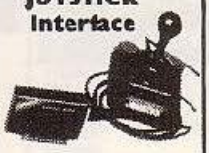

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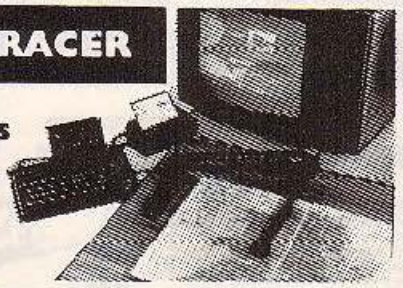

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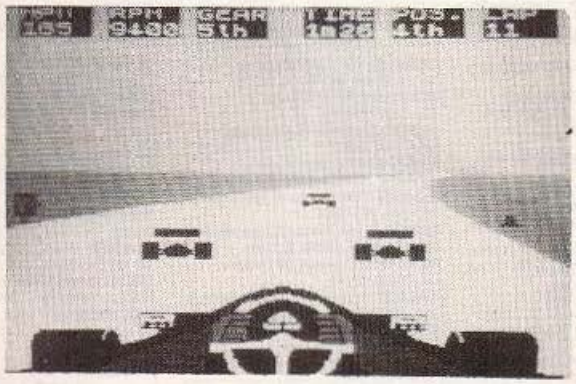

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SPRITES

Gary Priest presents a sprite routine for the Dragon.

AS MOST PEOPLE know the Dragon 32 does not have the ability to mix text and high resolution graphics or control sprites.

A Basic program that uses moving high resolution graphics is usually very slow, jerky, and wastes a lot of memory by having to keep checking for collisions etc. The main advantage of sprites are that once they are defined they can be forgotten about and they will continue to move until they come to the edge of the screen. This means that the characters move faster and smoother around the high resolution screen.

My sprite program can handle up to 30 sprites although if you use all 30 sprites at once they will move extremely slowly. In spite of this, they will still move faster than if you used the Dragon's Get and Put commands.

Each sprite has its own x and y co-ordinates and places in memory to store information such as the direction of the sprite.

The machine code, sprite and attributes and graphics data occupy about 4.5K at the top of memory.

(continued on page 147)

Listing 1.

```
10 REM ************************
20 REM **EXTENDED SPRITE BASIC**
30 REM **BY GARY PRIEST (C)1983*
40 REM ****FOR THE DRAGON 32****
50 REM ************************
60 REM listing one
70 REM INITIALISE
80 DATABE,75,36,A6,B0,BD,B0,CC,B1,00,26,F7,BE,7D,63,BF
,01,26,10,8E,81,CA,A6,A0,A7,E0,10,3C,82,2C,23,F6,86,A1
,A7,E0,10,8E,82,30,A6,A0,A7,E0
90 DATA10,3C,82,93,23,F6,BE,7D,E7,BF,01,28,10,8F,6E,69
,10,AF,88,36,BE,74,BE,BF,01,52,BE,74,93,BF,01,95,86,7E
,B7,01,91,B7,01,94,39
100 REM WHICH COMMAND
110 DATABE,74,B9,5F,10,9E,A6,A6,A4,A1,84,26,20,A6,80,8
1,80,24,06,A1,A0,25,16,20,F4,84,7F,A1,A0,26,0C,10,9F,A
6,58,BE,75,0F,3A,AE,E4,6E,B4,30,1F,A6,80,81,80,25,FA,5
C,C1,13,25,CC,7E,88,8D
120 REM MOVE SPRITES
130 DATAB6,01,B7,7E,6F,C6,01,B7,7E,6F,3D,C3,7E,71,1F,0
1,E6,80,B7,7F,65,B7,7F,66,C1,00,26,0A,B6,7E,6F,4C,B1,7
5,35,25,E0,39,C1,01,27,1A,C1,02,10,27,00,CA,C1,03,27,6
0,C1,04,10,27,00,8D,B6,7E,6F,4C,B1,75,35,25,C2,39
140 REM UP
150 DATAB6,7E,6F,C6,02,3D,C3,7E,95,1F,01,BF,7F,68,A6,8
0,E6,84,BD,6F,D3,C1,00,27,18,5A,BE,7F,68,A7,80,E7,84,B
D,70,2D,BD,70,00,B6,7E,6F,4C,B1,75,35,25,91,39,BD,70,2
D,3D,70,00,B6,7E,6F,C6,01,3D,C3,7E,71,1F,01,6F
160 DATAB4,B6,7E,6F,4C,B1,75,35,10,25,FF,72,39
170 REM DOWN
180 DATAB6,7E,6F,C6,02,3D,C3,7E,95,1F,01,BF,7F,68,A6,8
0,E6,84,BD,6F,D3,C1,16,27,C8,5C,BE,7F,68,A7,80,E7,84,B
D,70,2D,BD,70,00,B6,7E,6F,4C,B1,75,35,10,25,FF,3F,39
190 REM LEFT
200 DATAB6,7E,6F,C6,02,3D,C3,7E,95,1F,01,BF,7F,68,A6,8
0,E6,84,BD,6F,D3,B1,00,27,95,4A,BE,7F,68,A7,80,E7,84,B
D,70,2D,BD,70,00,B6,7E,6F,4C,B1,75,35,10,25,FF,0C,39
210 REM RIGHT
220 DATAB6,7E,6F,C6,02,3D,C3,7E,95,1F,01,BF,7F,68,A6,8
0,E6,84,BD,6F,D3,B1,1E,10,27,FF,60,4C,BE,7F,68,A7,80,E
7,84,BD,70,2D,BD,70,00,B6,7E,6F,4C,B1,75,35,10,25,FE,D
7,39
230 REM PRINT OLDCHR
240 DATA34,06,B7,7E,91,F7,7E,93,B6,7E,6F,C6,04,3D,C3,7
F,8B,1F,01,A6,80,B7,7E,D5,A6,80,B7,7E,D7,A6,80,B7,7E,D
9,A6,80,B7,7E,DB,BD,70,D2,35,06,39
250 REM PRINT SPRITE
260 DATA34,06,B7,7E,91,F7,7E,93,B6,7E,6F,C6,04,3D,C3,7
E,DD,1F,01,A6,80,B7,7E,D5,A6,80,B7,7E,D7,A6,80,B7,7E,D
9,A6,84,B7,7E,DB,BD,70,D2,35,06,39,34,06,B7,7E,91,F7,7
E,93,BD,70,81,F7,7E,D5,7C,7E
270 DATA91,BD,70,81,F7,7E,D7,7A,7E,91,7C,7E,93,BD,70,8
1,F7,7E,D9,7C,7E,91,BD,70,81,F7,7E,DE,7A,7E,91,7A,7E,9
3,C6,04,B6,7E,6F,3D,C3,7F,6B,1F,01,B6,7E,D5,A7,80,B6,7
E,D7,A7,80,B6,7E,D9,A7,80
280 DATAD6,7C,DD,A7,04,35,06,39,B6,7E,91,F6,7E,93,8E,0
6,00,30,86,30,89,01,00,5A,26,F9,C6,08,10,8E,7F,5D,A6,8
4,A7,A0,30,88,20,5A,26,F6,C6,00,F7,7F,F3,10,8E,7F,5D,8
6,08,3D,C3,75,69,1F,01,CA
290 DATA08,A6,A0,A1,80,26,07,5A,26,F7,F6,7F,F3,39,F6,7
F,F3,5C,F7,7F,F3,C1,00,26,DA,F6,7F,F3,39,B6,7E,D5,F6,7
E,91,F7,7F,ED,F6,7E,93,F7,7F,EB,BD,71,0F,7C,7E,91,B6,7
E,D7,BD,71,0F,7A,7E,91,7C
300 DATA7E,93,B6,7E,D9,BD,71,0F,7C,7E,91,B6,7E,DB,BD,7
1,0F,B6,7F,ED,F6,7F,EB,B7,7E,91,F7,7E,93,39,C6,08,3D,C
3,75,69,1F,02,8E,06
310 DATA00,B6,7E,91,F6,7E,93,30,86,30,89,01,00,5A,26,F
9,C6,08,A6,A0,A7,84,30,88,20,5A,26,F6,39
320 REM **COMMANDS**
330 REM CHAR
340 DATABD,8E,83,8C,00,FF,10,22,1A,4D,BF,7E,5F,B6,7E,6
0,C6,08,3D,C3,75,69,1F,02,C6,08,F7,7E,69,10,BF,7E,61,B
D,89,AA,BD,8E,83,8C,00,FF,10,22,1A,29,BF,7E,5F,10,BE,7
E,61,B6,7E,60,A7,A0,7A,7E,69,26,DE,16,03,0C
350 REM MOTION
360 DATABD,8E,83,BF,7E,6F,BD,89,AA,BD,8E,83,BF,7E,5F,B
6,7E,70,C6,01,3D,C3,7E,71,1F,01,B6,7E,60,A7,80,16,02,E
A
370 REM LOCATE
380 DATABD,8E,83,BF,7E,6F,BD,89,AA,BD,8E,83,BF,7E,91,B
D,89,AA,BD,8E,83,BF,7E,93,B6,7E,70,C6,02,3D,C3,7E,95,1
F,01,B6,7E,92,A7,80,B6,7E,94,A7,80,16,02,3A
390 REM SPRITE
400 DATABD,8E,83,BF,7E,6F,BD,89,AA,BD,8E,83,BF,7E,D5,B
D,89,AA,BD,8E,83,BF,7E,D7,DD,07,AA,DD,0C,03,DF,7C,D7,D
D,89,AA,BD,8E,83,BF,7E,DB,B6,7E,70,C6,04,3D,C3,7E,DD,1
F,01,B6,7E,D6,A7,80,B6,7E,D8,A7,80,B6,7E,DA,A7,80,B6,7
E,DC,A7,80,16,02,6F
410 REM PX
420 DATABD,8E,83,BF,7E,6F,B6,7E,70,C6,02,3D,C3,7E,95,1
F,01,E6,80,7E,8C,36
430 REM PY
440 DATABD,8E,83,BF,7E,6F,B6,7E,70,C6,02,3D,C3,7E,95,1
F,01,30,01,E6,80,7E,8C,36
450 REM FLASH
460 DATABD,8E,83,BF,7F,EF,BD,89,AA,BD,8E,83,BF,7F,F1,B
E,7F,EF,B6,FF,22,8A,08,B7,FF,22,10,BE,7F,F1,31,3F,26,F
C,B6,FF,22,80,08,B7,FF,22,10,BE,7F,F1,31,3F,26,FC,30,1
F,26,DC,16,02,07
470 REM KEY
480 DATABD,B9,E5,27,FB,1F,B9,7E,8C,36
490 REM TRIG1
500 DATAF6,FF,00,C4,01,7E,8C,36
510 REM TRIG2
520 DATAF6,FF,00,C4,02,54,7E,8C,36
530 REM XDIST
540 DATABD,8E,83,BF,7E,6F,BD,89,AA,ED,8E,83,BF,7E,5F,B
6,7E,70,C6,02,3D,C3,7E,95,1F,01,A6,84,B7,7E,91,B6,7E,6
0,C6,02,3D,C3,7E,95,1F,01,A6,84,B7,7E,93,B6,7E,91,B1,7
```

(listing 1 continued on page 147)

48K SPECTRUM

TASWORD TWO THE WORD PROCESSOR

64 CHARACTERS PER LINE ON THE SCREEN AND TO PRINTERS!

MICRODRIVE COMPATIBLE — instructions supplied

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TASMAN SOFTWARE

Dept. YC

17 HARTLEY CRESCENT LEEDS LS6 2LL

(listing 1 continued from page 145)

```
E,93,22,05,25,0D,16,01,D0,D0,7E,93,1F,E9,7E,8C,36,B6,7
E,93,B0,7E,91,1F,89,7E,8C,36
550 REM YDIST
560 DATABD,BE,83,BF,7E,6F,BD,B9,AA,BD,BF,83,BF,7E,5F,B
6,7E,70,C6,02,3D,C3,7E,95,1F,01,30,01,A6,84,B7,7E,91,B
6,7E,60,C6,02,3D,C3,7E,95,1F,01,30,01,A6,84,B7,7E,93,B
6,7E,91,B1,7E,93,22,82,25,B8,16,01,5D
570 REM COINC
580 DATABD,BE,83,BF,7E,6F,B6,7E,70,B7,7E,6F,C6,02,3D,C
3,7E,95,1F,01,A6,80,E6,84,B7,7E,91,F7,7E,93,36,01,B7,7
E,70,C6,02,3D,C3,7E,95,1F,01,A6,80,B1,7E,91,26,15,A6,8
0,B1,7E,93,26,0E,B6,7E,6F,B1,7E,70,27,C6,F6,7E,70,7E,8
C,36,B6,7E,70,B1,1F,10,27,01
590 DATAOD,4C,20,CD
600 REM BLSPR
610 DATABD,BE,83,BF,7E,6F,B6,7E,70,B7,7E,6F,C6,02,3D,C
3,7E,95,1F,01,A6,80,E6,84,BD,6F,D3,16,C0,EC
620 REM LASER
630 DATA34,32,B6,FF,23,BA,08,B7,FF,23,EE,00,01,B6,FD,B
7,FF,20,BD,19,7F,FF,20,BD,14,30,01,BC,C0,9B,25,FD,B6,F
F,23,B4,F7,B7,FF,23,35,32,16,00,BF,1F,12,31,3F,26,FC,3
9
640 REM NUM
650 DATABD,BE,83,8C,00,1E,22,0C,BF,7E,5F,B6,7E,60,B7,7
5,35,16,00,A4,7E,8B,8D
660 REM CURSET
670 DATABD,BE,83,BF,7E,5F,BD,B9,AA,B6,7E,60,81,20,22,E
D,B7,75,67,BD,BE,83,BF,7E,5F,B6,7E,60,81,18,22,DD,B7,7
5,6B,20,7C
680 REM PRINT ROUTINE
690 DATA1F,21,FC,75,67,34,06,A6,80,81,CD,26,0E,35,06,B
6,75,67,81,18,22,04,4C,B7,75,68,39,C6,08,3D,C3,7E,69,1
F,02,35,06,BD,74,41,4C,81,20,25,DB,4F,5C,C1,18,25,D2,5
A,BD,74,5E,20,CC,34,36,BE,06,00,30,86,30,B9,01,0C,5A,2
6,F9,C6,08,A6,A0,A7,84,30,88
700 DATA20,5A,26,F6,3B,36,39,34,36,C6,00,34,04,BD,74,6
F,35,04,5A,26,F6,35,36,39,CC,0C,00,20,8E,06,00,CE,06,2
0,AE,C1,AF,A1,5A,26,F9,4A,26,F6,39
710 REM ROUTINES
720 DATA5F,7E,8C,36,F7,7E,6A,9E,68,8C,FF,FF,26,0D,39,3
4,10,BE,FF,FF,BF,7E,5D,35,90,20,E5,BF,7E,6B,BE,7E,5D,8
C,FF,FF,27,EB,32,62,BD,BA,C3,0F,6F,BE,7E,6D,9F,A6,7E,8
5,A8
730 REM TABLE
740 DATA43,4B,41,D2,4D,4F,54,49,4F,CE,53,50,52,45,54,C
5,4C,4F,45,41,54,C5,50,DB,50,D9,46,4C,41,53,C8,54,52,4
9,47,B1,54,52,49,47,B2,4B,45,D9,5B,44,49,53,D4,59,44,4
9,53,D4,43,4F,49,4E,C3,42,4C,53,50,D2,4C,41,53,45,D2,4
6,52,45,C5,4D,4F,56,C5,4E,55
750 DATACD,43,55,52,53,45,D4
760 REM DISPATCH
770 DATA71,36,71,78,71,C0,71,9A,72,16,72,2C,72,44,72,D
7,72,BF,72,7D,72,98,72,E7,73,27,73,7A,73,98,8C,31,6E,A
4,73,CC,73,E3
780 REM DATA
790 DATAOD,45,58,54,45,4E,44,45,44,20,53,50,52,49,54,4
5,20,42,41,53,49,43,20,31,2E,30,0D,28,43,29,31,39,38,3
3,20,47,41,52,59,20,50,52,49,45,53,54,2E,2E,2E,0,0A,0A
800 POKE&H7E69,1
810 FOR A=&H7E7A TO &H7FF5:POKE A,32:NEXT
820 FOR A=28180 TO &H7568
830 READ A$:POKE A,VAL("&H"+A$)
840 NEXT
```

Listing 2.

```
00 00 00 00 00 00 00 00 00 18 18 18 18 00 18 18 00 28 28 28
00 00 00 00 00 24 24 24 FF 24 FF 24 24 00 08 3E 28 3E 08 3E 08
00 3C 40 24 00 22 52 2C 00 08 14 14 08 30 42 3D 00 10 18 18
00 00 06 00 00 08 10 20 20 10 08 04 08 08 02 02 02 04 08 08
00 18 54 38 38 54 18 00 00 08 08 38 7F 08 08 08 00 00 00 00
18 18 08 10 00 00 00 7F 00 00 38 38 00 00 00 00 00 18 18 18
00 01 0C 04 00 13 38 40 00 3C 66 3E 7E 76 66 3C 00 18 38 18
18 18 18 3C 00 3C 66 06 0C 18 38 7F 38 3C 66 06 1C 06 66 3C
00 06 1E 36 66 7F 06 06 60 7E 60 7C 26 06 66 3C 00 3C 66 60
7C 66 66 3C 00 7E 06 06 0C 18 30 60 30 3C 66 66 3C 66 66 3C
00 3C 66 66 3E 06 66 3C 00 00 18 00 00 18 18 00 00 18 18 00
18 18 06 18 00 01 02 04 08 04 02 01 38 00 00 7E 00 7E 00 00
00 00 40 20 18 20 18 00 00 3C 66 3C 3C 18 00 18 00 00 00 44 04
34 54 38 00 18 3C 66 66 7E 66 66 38 7C 66 66 7C 66 66 7C
00 3C 66 60 60 60 66 3C 00 78 6C 66 66 66 6C 78 00 7E 60 60
7C 60 66 7E 00 7E 60 60 7C 60 60 60 38 3C 66 60 60 66 66 3C
00 66 66 66 7E 66 66 66 00 3C 18 18 18 18 18 3C 00 06 06 06
06 06 06 3C 00 66 66 66 78 6C 66 66 38 66 66 66 66 66 66 66
00 66 78 7E 66 66 66 66 00 66 76 7E 7E 6E 66 66 00 3C 66 66
66 66 66 3C 00 7C 66 66 7C 60 60 60 00 3C 66 66 66 76 6C 36
00 7C 66 66 7C 6C 66 66 00 3C 66 60 3C 06 66 3C 00 7E 18 18
18 18 18 18 00 66 66 66 66 66 66 66 00 66 66 66 66 66 66 18
00 66 66 66 66 7E 7E 66 00 66 66 3C 18 3C 66 66 00 66 66 3C
18 18 18 18 00 66 66 66 66 7E 66 66 00 66 66 3C 18 18 18 18
00 7E 06 0C 18 30 60 7E 00 78 60 60 60 60 60 78 00 40 60 70
00 80 40 20 10 08 04 02 00 3E 02 02 02 02 02 3E 00 10 38 54
10 10 10 10 00 00 20 40 FE 40 20 00 FF C7 BB FB CB AB AB C7
00 00 00 3C 06 3E 66 3E 00 60 60 7C 66 66 66 7C 00 00 00 3C
66 60 66 3C 00 06 06 3E 66 66 66 3E 00 00 00 3C 66 7E 60 3C
00 3C 66 60 78 60 60 60 00 38 7C 44 44 7C 04 7C 00 60 60 7C
66 66 66 66 00 18 00 18 18 18 18 18 00 00 00 00 06 03 48 38
00 60 66 6C 78 6C 66 66 60 18 18 18 18 18 18 00 00 00 66
7E 7E 66 66 00 00 00 7C 66 66 66 66 00 00 00 3C 66 66 66 3C
00 00 78 44 44 7C 40 40 00 38 7C 44 44 7C 06 02 00 00 00 7C
66 60 60 60 00 3C 60 60 00 3C 60 3C 06 3C 00 00 18 3C 18 18 8C
00 00 00 66 66 66 66 3E 00 00 00 66 66 66 3C 18 00 00 00 66
66 7E 7E 66 00 00 00 00 00 3C 18 3C 66 00 00 60 60 60 7C 04 7C
00 00 00 7C 6C 18 30 7C FF 8F 8F 8F 8F 8F 8F 0F FF 7F 8F 0F
EF F7 FB FD FF F1 FD FD FD FD FD F1 FF EF CF 8B EF EF EF EF
FF FF DF BF 01 DF DF FF FF FF FF FF FF FF FF FF FF FF
```

(continued from page 145)

Before you type in the listing of the main machine code — listing 1, type:

CLEAR 200,28179

Then type in listing 2.

When you have checked that all the data is correct you can save the machine-code routine with the command:

CSAVEM"SPRITES",28180,32766,28180

You can now execute the machine code by typing:

EXEC 28180

You should see the message

EXTENDED SPRITE BASIC 1.0
© 1983 GARY PRIEST . . .

You are now in extended sprite Basic. To get some idea of what is posible with your new extended Basic enter the sprite demonstration program in listing 5. This program sets up the sprite attributes for the first eight sprites and defines four characters as one single man.

Four sprites start at the top of the screen and four at the bottom. These two groups go up and down the screen. When they reach the top or the bottom they bounce off the edges.

If you press Enter you will hear an odd sound — this is the sound produced by the !Laser command. The eight sprites will be blanked out and sprite two will be defined as a rough football. Sprite one is defined as a man. The man runs up to the football and kicks it.

When sprites move they do not destroy whatever they pass over as long as it is a defined character. To demonstrate this there is a third part of the demonstration program.

Listing 3.

```
10 REM LISTING THREE
11 REM
20 PMODE3:PCLS:SCREEN1,0
30 COLOR2
40 A$=INKEY$:IF A$="" THEN 40
50 IF A$>"0" AND A$<"5" THEN COLOR VAL(A$)
60 IF A$=CHR$(8) AND X>0 THEN X=X-1
70 IF A$=CHR$(9) AND X<7 THEN X=X+1
80 IF A$=CHR$(94) AND Y>0 THEN Y=Y-1
90 IF A$=CHR$(10) AND Y<7 THEN Y=Y+1
100 IF A$=CHR$(13) THEN 130
110 PSET(X,Y)
120 GOTO40
130 CLS:FOR A=1536 TO 1760STEP32:PRINTPEEK(A);:NEXT
```

To write your own programs that use sprites you must first understand what each new command does and the syntax for using it. You must also know how to define characters and sprites.

To define a character for use in PMode, 4,1 you must draw an 8 by 8 grid and draw your characters in the grid.

To be able to use the !Char command you must have eight pieces of data. These eight bytes make up the character. Take the top row. Look at the eight squares in the row. Add up the numbers above the filled in squares. eg., 4+8+16+32=50 so the first piece of data is 60. The whole man would be:

X=!CHAR chr no,60,60,60,24,255,
24,36,66

To design multicolour characters type in listing 3. Keys 1-4 change the colour and the arrow keys are used to draw your characters. When you are satisfied with your character press Enter. The program will print the eight pieces of data for you to use in a !Char statement.

To define a sprite you must use four characters that you have previously defined.

There are 11 new commands for the handling of sprites:

!SPRITE — This command is for defining sprites. You can define sprites 1-29 inclusive.

To use the command you must give the sprite number and four character numbers that make up the sprite eg.

X=!SPRITE 1,65,66,67,68

(continued on page 149)

AUSTRALIA IN 6 MINUTES?

Geography teacher Bob Phillips' program on the school's BBC Micro needed a map of Australia divided into states, with the names of states and cities appearing when requested by the student. Using an RD Digital TRACER, Bob prepared this usually laborious task in just six minutes. "It's so simple," he said "... it's traced directly from an atlas, scaled up or down as needed, and so I have a very accurate presentation, with plenty of colour and movement to maintain the kids' interest."

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(continued from page 147)

would define sprite 1 assuming that you have defined the letters of the alphabet. The character number may be 0-254.

!NUM — This command is used to control the number of sprites appearing on screen. You may have up to 29 sprites on screen at once.

To use the command you must add one to the number of sprites that you are going to use e.g., if you want two sprites then you must use

X = !NUM 3

!LOCATE — This command positions a sprite on the high resolution screen. You must use the sprite number, X co-ordinate (0-30), and the Y co-ordinate (0-22).

!MOTION — This command sets the direction in which a sprite is to move.

0 = STOP, 1 = UP, 2 = RIGHT,
3 = DOWN, 4 = LEFT.

To set the motion of sprite 1 use X= MOTION 1, direction.

!MOVE — This calls the machine code sprite move routine. It moves the sprites selected by !Num and that do not have a motion of 0.

When a sprite is about to move off the screen it stops automatically.

!PX — This returns the X co-ordinates of a chosen sprite eg., if sprite 1 is at 10,10 then using:

X = !PX 1

will return the value 10 in the variable X.

!PY — This works in the same way as !PX but returns the Y co-ordinate instead.

!XDIST — This command returns the distance between the X co-ordinates of two sprites eg.,

X = !XDIST 1,2

returns the difference between the X co-ordinates of sprites 1 and 2.

!YDIST — This command works in the same way as !XDist but returns the difference between the Y co-ordinates of two sprites.

!COINC — This command is used to detect collisions between two sprites.

If sprite is at 10,10 and so is sprite 3 then if you use

X = !COINC 1

then X will equal 3 or if you use

X = !COINC 3

then X will will equal 1. If sprite 3 was at 9,9 then

X = !COINC 1

would equal 0.

!BLSPR — This is useful for blanking out a certain sprite eg., if sprite 1 has come to the edge of the screen and has stopped then use

X = !BLSPR 1

This will not blank out whatever is underneath sprite 1.

There are eight new commands that are not for controlling sprites.

!CHAR — This command is used to define characters. You may define characters 0-254. You must give the character number and then the eight pieces of data separated by commas eg.,

X = !CHAR 32,0,0,0,0,0 0,0,0

will define character 32 as a space.

Listing 2 gives data for defining characters 32 to 128.

!FLASH a,b — This flashes the screen 'a' times with a delay of 'b' between flashes. ie.,

X = !FLASH 10,20000

!TRIG1 — This returns 0 if the fire button on the right joystick is pressed or 1 if not.

!TRIG2 — This works the same as !Trig1 but for the left joystick.

!KEY This waits for you to press a key. The ASCII value is returned ie., if you pressed A then 65 would be returned. If you press Break then 3 will be returned and the program will not Break.

!LASER — This produces a simple laser sound eg.,

X = !LASER

!FREE — This replaces the Dragon's Mem function. Try

PRINT MEM

You should get the result 0. Now try

PRINT! FREE

this gives you the amount of memory left.

!CURSET x,y — sets the position for printing on the high resolution screen. x is the x co-ordinate which may be between 0-32 and y is the y co-ordinate between 0-23.

To print on the high resolution screen, make a string of the characters you wish to print and add a carriage return ie.,

A$ = "DRAGONS RULE OK" + CHR$(13)

Make sure that near the beginning of the program you have a line stating:

DEFUSR 0 = &H7408

When you are ready to print, type

X = USR0(VARPTR(A$))

and the contents of A$ should be printed on the high resolution screen.

Please note that whatever variables I have used can be changed to whatever you like.

When a command needs numbers after it you can use variables ie., instead of

X = !NUM 3

you could give variable A the value of 3 and have

X = !NUM A

If anyone does not feel up to typing in the programs they can obtain a cassette tape of the programs from me at 167 Ludlow Road, Itchen, Southampton SO2 7EL. The cassette costs £3.

Listing 4.

```
20 REM ***SPRITE DEMO***
30 PMODE4:PCLS:SCREEN1,1
40 Q=!NUM 9:REM USE 8 SPRITES
50 REM DEFINE THE 4 CHRS
60 Q=!CHAR128,7,13,13,15,12,7,1,127:REM TOP LEFT OF MA
N
70 Q=!CHAR129,224,176,176,240,48,224,128,254:REM TOP R
IGHT OF MAN
80 Q=!CHAR130,127,1,1,2,4,8,16,32:REM BOTTOM LEFT OF M
AN
90 Q=!CHAR131,254,128,128,64,32,16,8,4:REM BOTTOM RIGH
T OF MAN
100 REM DEFINE THE SPRITES
110 FOR A=1 TO 8
120 Q=!SPRITE A,128,129,130,131:NEXT
130 REM LOCATE SPRITES
140 FOR A=1 TO 8:READ X,Y:Q=!LOCATE A,X,Y:NEXT
150 DATA1,0,8,0,15,0,23,0,4,20,11,20,18,20,26,20
160 REM GIVE THE SPRITES A DIRECTION
170 FOR A=1 TO 4:D1(A)=3:D2(A)=1:NEXT
180 FOR A=5 TO 8:D1(A)=1:D2(A)=3:NEXT
190 FOR A=1 TO 8:Q=!MOTION A,D1(A):NEXT
200 REM MOVE THOSE SPRITES
210 Q=!MOVE
220 P=!PY5:REM P=Y COORDINATE OF SPRITE 5
230 IF P=0 THEN GOSUB270:REM IF SPRITE 5 IS AT TOP OF
SCREEN THEN CHANGE DIRECTION OF ALL SPRITES SO THAT TH
EY BOUNCE
240 IF P=22 THEN 190:REM IF AT BOTTOM THEN CHANGE DIRE
CTION SO THAT THEY BOUNCE
250 A$=INKEY$:IF A$=CHR$(13) THEN 290
260 GOTO210:REM MOVE THOSE SPRITES AGAIN
270 FOR A=1 TO 8:Q=!MOTION A,D2(A):NEXT
280 RETURN
290 Q=!LASER:IF FLAG=1 THEN 720
300 REM FLASH THE SCREEN
310 Q=!FLASH10,20000
320 SCREEN1,1
330 REM BLANK OUT THE SPRITES
340 REM PCLS WILL DO THE SAME
350 FOR A=1 TO 8:Q=!BLSPR A:NEXT
360 Q=!NUM3:REM USE 2 SPRITES
370 Q=!LOCATE1,2,10
380 Q=!MOTION1,2:REM IT'S GOING RIGHT
390 REM DEFINE A ROUGH FOOTBALL
400 Q=!CHAR132,255,255,255,255,255,255,255,255
410 Q=!CHAR32,0,0,0,0,0,0,0,0
420 Q=!SPRITE2,32,32,132,32
430 Q=!LOCATE2,20,11
440 Q=!MOTION2,1
450 REM MOVE THAT FOOTBALLER
460 Q=!MOVE
470 Q=!MOTION2,0
480 FOR A=1 TO DL:NEXT
490 TEST=!XDIST1,2:IF TEST=2 THEN 510:REM HAS HE REACH
ED THE FOOTBALL
500 GOTO460
510 Q=!MOTION1,0:REM STOP FOOTBALLER
520 Q=!MOTION2,2:REM SET BALL IN MOTION
530 Q=!MOVE:REM MOVE THE BALL
540 TEST=!PX2:IF TEST=30 THEN GOTO 570
550 FOR A=1 TO DL:NEXT
560 GOTO530
570 CLS:PRINT"*****ACTION REPLAY*****"
580 FOR A=1 TO 1000:NEXT
590 IF DL=70 THEN 630
600 DL=70
610 SCREEN1,1:PCLS
620 GOTO330
630 DEF USR0=&H7408:REM ADDR OF PRINT ROUTINE
640 Q=!CURSET0,12:REM PRINT AT 0,12
650 CLS:PRINT"THE SPRITES DO NOT DESTROY ANY  DEFINED
CHARACTERS THAT THEY    PASS OVER!":PRINT"PLEASE PRESS
 A KEY AND WATCH "
660 Q=!KEY
670 SCREEN1,1:PCLS
680 Z$=STRING$(32,132)+CHR$(13):Q=USR0(VARPTR(Z$)):REM
 PRINT Z$
690 RESTORE
700 FLAG=1
710 GOTO40
720 CLS:PRINT"THAT WAS THE END OF THE DEMO    PROGRAM!
":END
```

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TOOLKIT

John Charlesworth takes the hassle out of program writing.

TOOLKIT PROGRAMS have been published before, mostly concerned only with graphics and/or sound. This is all very well but first you need to have written a Basic program to use them and because of the nature of Basic the result is very often a mess, tailends of unwanted programs and line numbers going up in random steps.

This program is designed to aid the program writer by providing a number of useful, user friendly routines to take a lot of the work out of program writing and developing. The first and most important of these is the renumber routine. Renumber routines have been published before but these were all very limited as all they could do was renumber the line numbers, not the Goto, Gosub etc. This renumber routine is different, it will renumber the program using a specified start and step value and after renumbering the line numbers it will renumber all the Goto's, Gosubs, Run, Lists, LLists, and restores. The only disadvantages, and these are very small, are:

■ The routine will not renumber lines as:

SAVE "filename" LINE number

■ The routine will not renumber lines of the form Goto calculation. For example:

GOTO 1000+(100 AND x=3)+(200 AND x=7)

■ The routine will not renumber Gotos etc. which refer to non-existant lines.

In the event of the first or third occuring the computer will ignore it but in the event of the second the computer will print the message

Can't renumber line nnnn

nnnn being the offending line and the routine will return having done nothing.

The second routine provided by this toolkit is a Rem kill routine. During program development Rem statements are very useful but when the program is finished they no longer serve any purpose and simply slow down loading and saving so what this program does is search through the program for Rem statements and when it finds one it deletes it.

The third routine is a block delete. This program will remove all the lines between two specified lines and is useful for example to

(continued on page 153)

Listing 1.

```
10 DEF FN x(a$)=16*(CODE a$-48
-(39 AND a$(1)>"9"))+(CODE a$(2)
-48-(39 AND a$(2)>"9"))
20 CLEAR 31270: PRINT "Poking
in progress": LET x=31276
30 FOR a=0 TO 20: READ a$: LET
 t=0: LET t1=VAL a$( TO 4): LET
a$=a$(5 TO )
40 FOR b=0 TO 63: LET y=FN x(a
$(b*2+1 TO b*2+2)): POKE x,y: LE
T t=t+y: LET x=x+1: NEXT b
50 IF t<>t1 THEN PRINT "Error
in line ";100+a*10: STOP
60 NEXT a: PRINT "Finished": S
TOP
100 DATA "7505cd367acd967ccddc7
cc92a535ced5b4b5ca7ed5219c82be5d
de123232323237efe0e2006232323232
3237efe0d281bfee12824fee52820fee
c281cfeed2818fe"
110 DATA "7046f02814fef72810231
8d5ed5b4b5c1b1ba7ed521938c1c9237
efe0d28edfe3a28befe0e20072323232
32318eb4e303806fe3a300218e1dde5c
d6b0drdcd1f21c3"
120 DATA "64437a7efe0c2804d7231
8f7dde1dd4601dd4e02cd1t1ac1c9160
00043616e27742072656e75646265722
06c696e65200d3eff18023e2fa73ced5
230fb19c9e53e0a"
130 DATA "7388a711e803ed5219301
33da7116400ed521930093ca71e0aed5
230013de1c9e5e5eb131afe0e20fa7bc
6053001145fe1d5eba7ed527dd1e1c9e
511e803a7ed5219"
140 DATA "44933013116400a7ed521
9300f1e0aa7ed5219300f1814cddf7a0
203116400cddf7a02031e0acddf7a020
37dc63002033e0e02039702030203e17
d02037c02039702"
150 DATA "8696c9fd2a535cfd2bfde
5c1fd5e03fd56041313131fd.9fde5d
1a7ed521930e8c5fde1c916005ffe0a3
80115cddf7dfc6604fd6e0219fd7404f
d7503fde5e1d5dd"
160 DATA "8158e5d1a7ed52:93004d
1dd19c9d1c9e5cd0a7b472a005bcde97
ae1e5b8281b9023f5e02a615ca7ed524
44d626bed44853001246fedb0f1cd8f7
b2a005bc103cd24"
170 DATA "73557bc9e5cd0a7b472a0
05bcde97ae1e5b828e79023f5eb2a615
ca7ed52444d19545d833001145fedb81
8cbe5237cfe0d2810fe3a200cfe0e280
afe303804fe3a38"
180 DATA "6781eae1c92323235e235
6dd6601dd6e02a7ed521920ece1e5cd6
d7b3a025bfe002005cdba7b1803cdee7
be123c92a535c232323237efe0d2825f
e0e200423231ef"
190 DATA "7534fee12814fee52810f
eec280cfeed2308fef02804fef720dac
d167c18d5ed5b4b5c1b1ba7ed521938c
6c9f3fde5dd2a535cdd2b3e0032025b2
1000022005bcd58"
200 DATA "73807c2a005bdd7401dd7
502dd5e03cd5604dd19110400dd192a0
05b2322005bdde5e1ed5b4b5c1ba7ed5
21938d2fde1fbc9f3fde52a4b5c2b2cc
d6d7bfde5cde1dd"
210 DATA "68864e02dd46012a035ed
5b055b97190bb920fbb820f8444ded4
3005b3e0132025bcd587c2a005bdd740
1dd7502ed4b055ba7ed4222005bdde5e
12bcd6d7bfde5dd"
220 DATA "7633e12a035bed5b055ba
7ed52ed5b005ba7ed521920cbfde1fbc
92a4b5ced5b535c131313a7ed5219d8d
u2a535cdd2bdde5e123232323237efe0
e20032318f3feea"
230 DATA "705828.4fe0d20efe5dde
1ed5b4b5c1b1ba7ed521930dcc9cde3d
1131313131313a7ed52:928350100002b5
45d03131afe0d20f9ebe5d5210000a7e
d42ebdd6604dd6e"
240 DATA "80670319dd7503dd7404c
ddf7dd1a7ed52444de1edb0dde5e1189
8dde5e1dd5604dd5e0319110400 19dde
5d1e5d5eba7ed52eb18d52a4b5c19224
b5c2a595c192259"
250 DATA "69015c2a615r192261 5rr
9dd2a535cdde5e1ed5b4b5c1b1ba7ed5
2d0dc2b2a035bdd5e02dd5601eba7ed5
219eb301ccd5e03dd5604dd19110400d
d19ed5b4b5c1b1b"
260 DATA "7322dde5e1a7ed5238d4c
9dd22035b2a055bdd5e02dd5601eba7e
d5219eb301ddd5e03dd5604dd19110400
dd19ed5b4b5c1b1bdde5e1a7ed5238d
4180420 0ddd5e03"
270 DATA "7586dd5604dd19110400d
d19dd22055b2a615ced5b055ba7ed524
44debed5b035bedb02a035bed5b055ba
7ed52ebcddf7dc7cd6b0dcdcd1f3e16d
757d797d72a595c"
280 DATA "7700ed5b4b5c1313a7ed5
2d82a4b5c463e14a0c640477ee6e0fc6
0200878d7110600191853fea0200c78d
7237efe8038f9d68018e9fee0200d78f
53ef3d7f1d71113"
290 DATA "5986001918 32fe8020107
8d73e28d73e29d7235e235623191 81ef
e40200d78d73e24d7235e235A192318 0
d78d73e24d73e28d73e29d716ebed5b5
95c3e06d71ba7ed"
300 DATA "3596521938893e0dd73e4
dd73e65d73e6dd73e3dc72a595ced5b4
b5ca7ed52444dc900000000000000000
00000000000000000000000000000000
00000000000000"
9994 CLS : PRINT '1) Renumber"'"
2) Remkill"'"3) Delete"'"4) Vari
able list': INPUT fff: LET zzz=(
31276 AND fff=1)+(32069 AND fff=
2)+(32245 AND fff=3)+(32412 AND
fff=4): IF NOT zzz THEN GO TO 99
94
9995 LET ttt=1: LET fff=1: IF zz
z=31276 THEN INPUT "Start ";fff,
"Step ";ttt
9996 IF zzz=32245 THEN INPUT "Fr
om ";fff,"To ";ttt.
9997 IF fff>9999 OR fff<1 OR ttt
>9999 OR ttt<1 OR (fff>ttt AND z
zz=32245) THEN GO TO 9994
9998 POKE 23300,INT (fff/256): P
OKE 23299,fff-256*PEEK 23300: PO
KE 23302,INT (ttt/256): POKE 233
01,ttt-256*PEEK 23302: IF zzz=32
412 THEN PRINT USR zzz: STOP
9999 RANDOMIZE USR zzz
```

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Listing 2.

```
  10 DEF FN x(a$)=16*(CODE a$-48
-(39 AND a$(1)>"9")):+(CODE a$(2)
-48-(39 AND a$(2)>"9"))
  20 CLEAR 64040: PRINT 'Poking
in progress": LET x=64048
  30 FOR a=0 TO 20: READ a$: LET
 t=0: LET t1=VAL a$( TO 4): LET
a$=a$(5 TO )
  40 FOR b=0 TO 63: LET y=FN x(a
$(b*2+1 TO b*2+2)): LET t=t+y: P
OKE x,y: LET x=x+1: NEXT b
  50 IF t=t1 THEN NEXT a: PRINT
"Finished": STOP
  60 PRINT "Error in line ";100+
a*10: STOP
 100 DATA "7901cd3afacd9afccde0f
cc92a535ced5b4b5ca7ed5219c82be5d
de123232323237efe0e2006232323232
3237efe0d281bfee12824fee52820fee
c281cfeed2818fe"
 110 DATA "7050f02814fef72810231
8c5ed5b4b5c1b1ba7ed521938c1c9237
efe0d28edfe3a28befe0e20072323232
32318ebfe303806fe3a300218e1dde5c
d6b0dcdcd1f21c7"
 120 DATA "657:fa7efe0d2804d7231
8f7dde1dd4601dd4e02cd1b1ac1c9160
00043616e77742072656e756d62657322
06c696e65200d3eff18023e2fa73ced5
230fb19c9e53e0a"
 130 DATA "7388a711e803e5219301
33da7116400ed521930093da71e0aed5
230013de1c9e5e5eb131afe0e20fa7bc
6053001145fe1d5eba7ed527cd1e1c9e
511e803a7ed5219"
 140 DATA "4889301311640 0a7ed521
9300f1e0aa7ed5219300f1814cde3fa0
203116400cde3fa02031e0acce3fa020
37dc63002033e0e02039702030203e17
dc02037c02039702"
 150 DATA "8828c9fd2a535cfd2bfde
5c1fd5e03fd56041313131 3fd19fde5d
1a7ed521930e8c5fde1c9160c5ffe0a3
80115cde3fdfd6604fdce03 14fd7404f
d7503fde5e1d5dd"
 160 DATA "8558e5d1a7ed52193004d
1dd19c9d1c9e5cc0efb472a005bcded+
aele5b828 1b9023f5eb2a615ca7ed524
44d626bed4485300 1246fedb0f1cd93f
b2a005bc103cd28"
 170 DATA "7747fbc9e5cd0efb472a0
05bcdedfaele5b828e79023f5eb2a615
ca7ed52444d17545d833001145fedb81
8cbe5237efe0d2810fe3a280cfe0e280
afe303804fe3a38"
 180 DATA "7177eae1c92323235e235
6dd6e01dd6e02a7ed521920ece1e5cd7
1fb3a025bfe002005cdbefb1303cdf2f
be123c92a535c232323237efe0c2825f
e0e200423218ef"
 190 DATA "7770fee12814fee52810f
eec280cfeed2808fef02804fef720dac
d1afc18d5ed5b4b5c1b1ba7ed521938c
6c9f3fde5dd2a535cdd2b3e0032025b2
100c022005bcd5c"
 200 DATA "8140fc2a005bdd7401dd7
502dd5e03dd5604dd19110400dd192a0
05b2322005bdde5e1ed5b4b5c1ba7ed5
21938d2fde1fbc9f3fde52a4b5c2b2bc
d71fbfde5dde1dd"
 210 DATA "71504e02dd46012a035be
dcb055b97190bb920fbb820f8444ded4
3005b3e0132025bcd5cfc2a005bdd740
1dd7502ed4b055ba7ed4222005bdde5e
12bcd71fbfde5dd"
 220 DATA "7633e12a035bed5b055ba
7ed52ed5b005ba7ed521920cbfde1fbc
92a4b5ced5b535c131313a7ed5219d8d
d2a535cdd2bdde5e123232323237efe0
e20032318f3feea"
 230 DATA "70502014fe0d20efe5dde
1ed5b4b5c1b1ba7ed521938dcc9dde5d
11313131313a7ed521928350100002b5
45d03131afe0d20f9ebe5d5210000a7e
d42ebcd6604ddbe"
 240 DATA "8199c319dd7503dd7404c
de3fde1a7ed52444de1edb0ddde5c1189
8dde5e1dd5604dd5e031911040019dde
5d1e5c5eba7ed52eb18d52a4b5c19224
b5c2a595c192259"
 250 DATA "69015c2a615c1922615cc
9dd2a535cdde5e1ed5b4b5c1b1ba7ed5
2d0dd2b2a035bdd5e02dd5601eba7ed5
219eb301cdd5e03dd5604dd19110400d
d19ed5b4b5c1b1b"
 260 DATA "7322dde5e1a7ed5238d4c
9dd22035b2a055bdd5e02dd5601eba7e
d5219eb301ddd5e03dd5604cd1911040
0dd19ed5b4b5c1b1bdde5e1a7ed5238d
418 0f200ddd5e03"
 270 DATA "77:8dd5604dd19110400d
d19dd22055b2a615ced5b055ba7ed524
44debed5b035bedb02a035bed5b055ba
7ed52ebcde3fdc9cd6b0dzdcd1f3e16d
797d797d72a595c"
 280 DATA "7700ed5b4b5c1313a7ed5
2d82a4b5c463e1fa0c640477eeb0e0fe6
0200878d711060019185 3fea0200c78d
7237efe8038f9d6801 8e9fee0200d78f
53ef3d7f1d711:3"
 290 DATA "5986001918 32fe802c107
8d73e28d73e29d7235e23562319161ef
e40200d78d73e24d7235e2356192318 0
d78d73e24d73e28d73e29d718ebed5b5
95c3e06d71ba7ed"
 300 DATA "5479521938893e0dd73e4
cd73e65d73e6dd73e3dd72a595ced5b4
b5ca7ed52444de9877776 1b03130c3e0
03c42427e424200007c427c42427c000
03c424040423c00"
9994 CLS : PRINT "1) Renumber"'"
2) Reskill"'"3) Delete"'"4) Vari
able list": INPUT fff: LET zzz=(
64048 AND fff=1)+(64841 AND fff=
2)+(65017 AND fff=3)+(65184 AND
fff=4): IF NOT zzz THEN GO TO 99
94
9995 LET ttt=100: LET fff=ttt: I
F zzz=64048 THEN INPUT "Start ":
fff,"Step ";ttt
9996 IF zzz=65017 THEN INPUT "Fr
om ";fff,"To ";ttt
9997 IF fff>9999 OR fff<1 OR ttt
>9999 OR ttt<1 OR (fff>ttt AND z
zz=65017) THEN GO TO 9994
9998 POKE 23300,INT (fff/256): P
OKE 23299,fff-256*PEEK 23300: PO
KE 23302,INT (ttt/256): POKE 233
01,ttt-256*PEEK 23302: IF zzz=65
184 THEN PRINT USR zzz: STOP
9999 RANDOMIZE USR zzz
```

(continued from page 151)

remove all unused sections of programs.

The final routine is a variable list. This routine when called will list all the variables used by the program so far and how much total memory is being used.

The routines together take up about 1300 bytes. To enter them, type in listing 1 — for the 16K version — or listing 2 — for the 48K version. When run these programs Poke in the machine code from hex data statements, above Ramtop. Run the program and if the program reports finding a data error, correct the offending line and Return until the program prints "finished".

The routines should now be in place and error free — a checksum checks each line — and so the data is no longer needed and so should be deleted. However the toolkit can help you here. Run line 9994 and type 3 in response to the menu to select the block delete. The computer will then ask for the first and last lines to be deleted so type 1 then 1000.

The routines should now be saved using

SAVE "TOOLKIT":SAVE "BYTES"

Listing 3.

```
   1 RUN 3
   3 FOR a=3 TO 4: NEXT a: DIM a
$(3,2): DIM x(7)
  10 PRINT 'hello": REM title
  17 LET b$="string variable"
  20 GO SUB 100: RESTORE 10: LLI
ST 17: LIST 100
  30 GO TO z*100
 100 LET z=1: RETURN
 110 REM the end
```

CODE 31276, 1300

for a 16K Spectrum or

SAVE "TOOLKIT":SAVE "BYTES"
CODE 64048,1330

for a 48K Spectrum. To load the program in future type

LOAD "":CLEAR 31270 LOAD "" CODE

for the 16K Spectrum or

LOAD "":CLEAR 64040:LOAD "" CODE

for the 48K Spectrum.

If you now type in listing 3 — do not delete lines 9994-9999 — you may test out the other routines.

Run the toolkit — Run 9994 — and the menu will be printed out. You may notice from the listing that there are a couple of unnecessary Rem statements so why not delete them. In response to the menu type 2 to get the Rem delete. If you now list the program you will see the Rem statements have disappeared. Renumber the program.

Type Goto 9994 and in response to the menu type 1 to get the renumber routine and then in response to the promps type the lowest line number you want, 10 is normal, and to the second prompt type the step between successive lines, again 10 is normal. Immediately the message

Can't renumber line 30

will appear. If you list the program you can see the problem — line 30 has a Goto calculation. Delete line 30 — you could always replace it later — and again type Goto 9994 and type in the responses as before. You may get an error message when renumbering is complete. It should be ignored.

To test the final routine type Goto 70 and in response to the menu type 4. The variables used should be listed on the screen and the total memory printed at the bottom. ■

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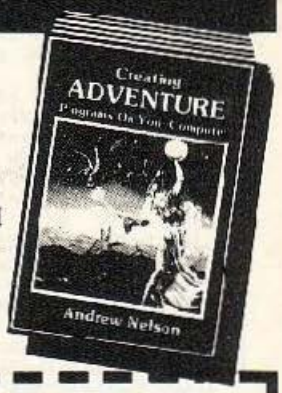

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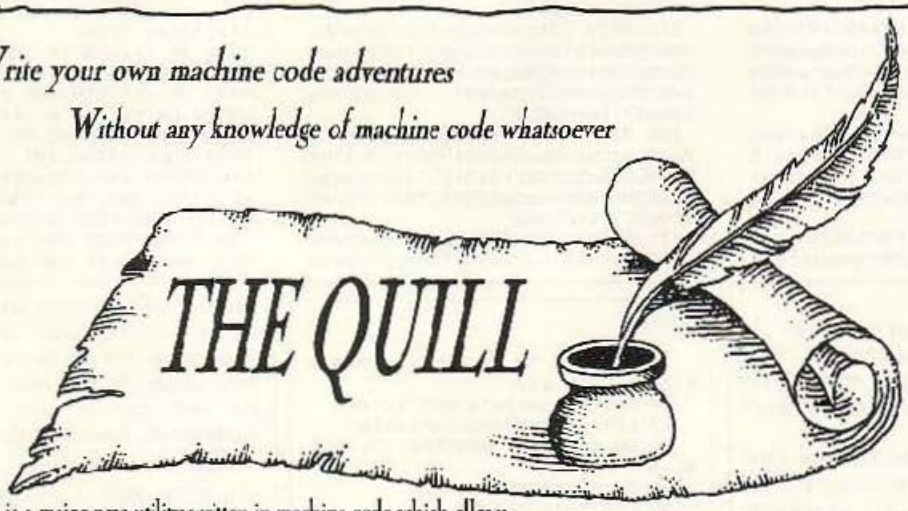

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PERSPECTIVE AND PROJECTIONS

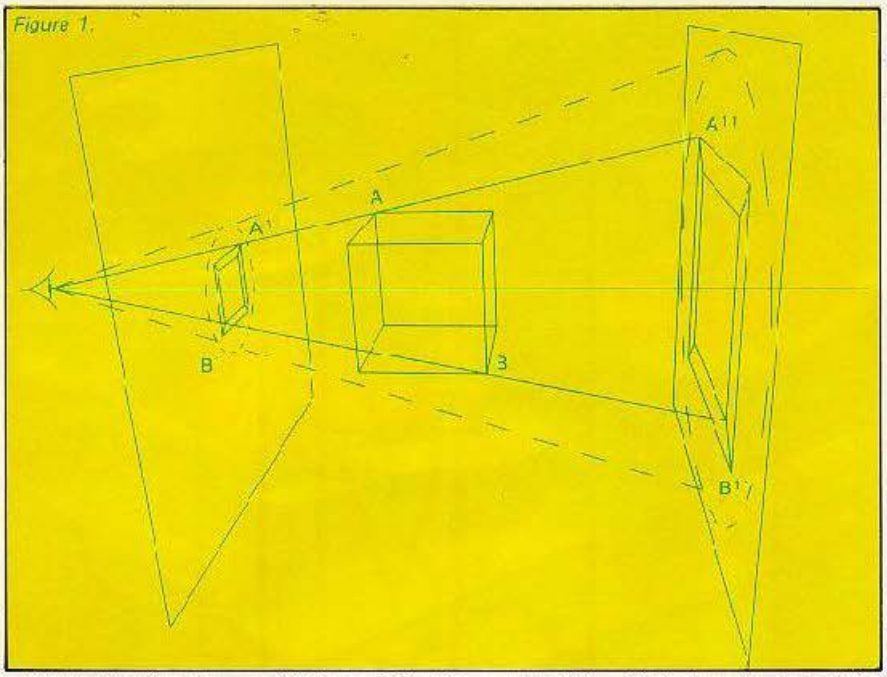
IN A PREVIOUS ARTICLE in the February edition of *Your Computer* I gave a method for drawing pictures of three dimensional wire-objects on the screen of a BBC micro. I looked at the simplest type of projection which maps a 3-D scene onto a 2-D screen. This orthographic projection has the property that parallel lines in 3-D space are projected into parallel lines on the screen. Although very useful, such views do look odd! Our brains are used to the perspective phenomenon of 3-D space, and so they attempt to interpret orthographic pictures as if they are perspective views and so they look distorted.

So it is essential to produce a projection which displays perspective phenomena i.e. parallel lines should meet on the horizon: an object should appear smaller as it moves away from the observer. The drawing board methods devised by artists over the centuries are of no value to us. Three dimensional co-ordinate geometry, however, furnishes us with a relatively straightforward technique.

A perspective view

To produce a perspective view we introduce a very simple definition what we mean by vision. We imagine every visible point in space sending out a ray which enters the eye. Naturally the eye cannot see all of space, it is limited to a cone of rays which fall on the retina, the so-called cone of vision, which is outlined by the dashed lines of figure 1. The axis of this cone is called the straight-ahead ray. We imagine that the eye at the origin and the straight ahead ray identified with the positive z-axis of our co-ordinate system.

Figure 1.



We imagine the screen — which we call the perspective plane — perpendicular to the axis of the cone of vision at a distance from the eye. In order to form the perspective projection we mark the points of intersection of each ray with this plane. Since there are an infinity of such rays this appears to be an impossible task. Actually the problem is not that great because we need only consider the rays which emanate from the important points in the scene eg. the vertices at the ends of line segments. The final view is formed by drawing lines between the projected points on the screen in exactly the same way as the equivalent vertices are related in 3-D space.

Figure 1 shows a cube observed by an eye and projected onto two planes: and the whole scene is also drawn in perspective. Two example rays are shown: the first from the eye to A, one of the near corners of the cube relative to the eye, and the second to B one of the far corners of the cube. The perspective

Listing 1.

```
100REM MAIN PROGRAM
1101INPUT"Which MODE"MOWD : MODE MOWD
1201INPUT"HORIZ",HORIZ : VERT=3*HORIZ/4
130PROCstart(3,0)
140PROCsetorigin(HORIZ/2,VERT/2)
150PROCscene3
160END
5000REM genrot / rotate space about a general axis
5310DEF PROCgenrot(PX,PY,PZ,Q,QX,QZ,GAMMA)
5320LOCAL ALPHA,BETA
5330PROCtran3(-PX,-PY,-PZ) : PROCmult3
5340ALPHA=FNangle(QX,QY)
5350PROCrot3(-ALPHA,3) : PROCmult3
5360BETA=FNangle(QZ,SQR(Q1*QX+QY*QY))
5370PROCrot3(-BETA,2) : PROCmult3
5380PROCrot3(GAMMA,3) : PROCmult3
5390PROCrot3(BETA,2) : PROCmult3
5400PROCrot3(ALPHA,3) : PROCmult3
5410PROCtran3(PX,PY,PZ) : PROCmult3
5420ENDPROC
8200REM look3 / maintain vertical
8210DEF PROClook3
8220LOCAL FX,FY,FZ,THETA
8230CLS : INPUT"(EX,EY,EZ)",EX,EY,EZ
8240INPUT"(DX,DY,DZ)",DX,DY,DZ
8250PROCtran3(-DX,-DY,-DZ) : PROCmult3
8260FX=EX-DX : FY=EY-DY : FZ=EZ-DZ
8270THETA=FNangle(FX,FY)
8280PROCrot3(-THETA,3) : PROCmult3
8290DIST=SQR(FX*FX+FY*FY)
8300THETA=FNangle(FZ,DIST)
8310PROCrot3(PI-THETA,2) : PROCmult3
8320DIST=SQR(DIST*DIST+FZ*FZ)
8330THETA=FNangle(DIST*FX,-FY*FZ)
8340PROCrot3(THETA,3) : PROCmult3
8350PROCtran3(0,0,DIST) : PROCmult3
8360ENDPROC
8600REM rot3
8610DEF PROCrot3(THETA,AXIS)
8620LOCAL AX1,AX2,CT,ST
8630AX1=(AXIS MOD 3)+1
8640AX2=(AX1 MOD 3)+1
8650CT=COS(THETA) : ST=SIN(THETA)
8660A(AXIS,AXIS)=1 : A(AXIS,AX1)=0 : A(AXIS,AX2)=0
8670A(AX1,AXIS)=0 : A(AX1,AX1)=CT : A(AX1,AX2)=-ST
8680A(AX2,AXIS)=0 : A(AX2,AX1)=ST : A(AX2,AX2)=CT
8690A(1,4)=0 : A(2,4)=0 : A(3,4)=0
8700A(4,1)=0 : A(4,2)=0 : A(4,3)=0 : A(4,4)=1
8710ENDPROC
8800REM angle
8810DEF FNangle(AX,AY)
8820IF ABS(AX)>0.00001 THEN 8860
8830IF ABS(AY)<0.00001 THEN =0
8840IF AY<0 THEN =1.5*PI
8850=PI/2
8860IF AX<0 THEN =(ATN(AY/AX)+PI) ELSE =ATN(AY/AX)
9000REM tran3
9010DEF PROCtran3(TX,TY,TZ)
9020A(1,1)=1 : A(1,2)=0 : A(1,3)=0 : A(1,4)=TX
9030A(2,1)=0 : A(2,2)=1 : A(2,3)=0 : A(2,4)=TY
9040A(3,1)=0 : A(3,2)=0 : A(3,3)=1 : A(3,4)=TZ
9050A(4,1)=0 : A(4,2)=0 : A(4,3)=0 : A(4,4)=1
9060ENDPROC
9100REM mult3
9110DEF PROCmult3
9120LOCAL IX,JX,KX,AR
9130FOR IX=1 TO 4
9140FOR JX=1 TO 4
9150AR=0
9160FOR KX=1 TO 4
9170AR=AR+A(IX,KX)*B(KX,JX)
9180NEXT KX
9190B(IX,JX)=AR
9200NEXT JX
9210NEXT IX
9220FOR IX=1 TO 4
9230FOR JX=1 TO 4
9240A(IX,JX)=B(IX,JX)
9250NEXT JX
9260NEXT IX
9270ENDPROC
9300REM idm3
9310DEF PROCidM3
9320A(1,1)=1 : A(1,2)=0 : A(1,3)=0 : A(1,4)=0
9330A(2,1)=0 : A(2,2)=1 : A(2,3)=0 : A(2,4)=0
9340A(3,1)=0 : A(3,2)=0 : A(3,3)=1 : A(3,4)=0
9350A(4,1)=0 : A(4,2)=0 : A(4,3)=0 : A(4,4)=1
9360ENDPROC
9400REM lineto
9410DEF PROClineto(XPT,YPT)
9420DRAW FNX(XPT),FNY(YPT)
9430ENDPROC
9500REM moveto
9510DEF PROCmoveto(XPT,YPT)
9520MOVE FNX(XPT),FNY(YPT)
9530ENDPROC
9600REM setorigin
9610DEF PROCsetorigin(XMOVE,YMOVE)
9620XORIG=XORIG+XMOVE : YORIG=YORIG+YMOVE
9630PROCmoveto(0,0)
9640ENDPROC
9700REM start
9710DEF PROCstart(B,F)
9720XORIG=0 : YORIG=0
9730NXPIX=1280 : NYPIX=960
9740YSCALE=NXPIX/HORIZ : YSCALE=NYPIX/VERT
9750IF XYSCALE>YSCALE THEN XYSCALE=YSCALE
9760VDU28,0,1,39,0 : VDU24,0;0;1279;959;
9770COL 0,16128 : CLG : COL 0,F
9780ENDPROC
9800REM real-to-pixel functions
9810DEF FNX(I)=INT((XORIG+I)*XYSCALE+0.5)
9820DEF FNY(I)=INT((YORIG+I)*XYSCALE+0.5)
```

D STEREOSCOPIC

I O Angell considers ways of producing perspective projections on screen.

Listing 2.

```
6000REM scene3 / consisting of a cube
6010DEF PROCscene3
6020DIM X(8),Y(8),Z(8),XD(8),YD(8)
6030DIM LIN(2,12),A(4,4),B(4,4),R(4,4)
6040NOV=0 : NOL=0 : PPD=3*VERT
6049REM place CUBE in SETUP position
6050PROCidR3 : PROCobject
6059REM find OBSERVED position.
6060PROCidR3 : PROClook3
6069REM draw the scene
6070PROCdrawit
6079REM repeat
6080GOTO 6060
6090ENDPROC
6500REM object / add to data base
6510DEF PROCobject
6519REM data for a CUBE
6520LOCAL I%,XX,YY,ZZ,L1,L2
6530DATA 1,2, 2,3, 3,4, 4,1, 5,6, 6,7, 7,8, 8,5, 1,5,
2,6, 3,7, 4,8
6540DATA 1,1,1, 1,1,-1, 1,-1,-1, 1,-1,1, -1,1,1, -1,1
,-1, -1,-1,-1, -1,-1,1
6550RESTORE
6559REM store line information.
6560FOR I%=1 TO 12
6570READ L1,L2 : NOL=NOL+1
6580LIN(1,NOL)=L1+NOV : LIN(2,NOL)=L2+NOV
6590NEXT I%
6599REM store vertex information put in position by m
atrix R.
6600FOR I%=1 TO 8
6610READ XX,YY,ZZ : NOV=NOV+1
6620X(NOV)=R(1,1)*XX+R(1,2)*YY+R(1,3)*ZZ+R(1,4)
6630Y(NOV)=R(2,1)*XX+R(2,2)*YY+R(2,3)*ZZ+R(2,4)
6640Z(NOV)=R(3,1)*XX+R(3,2)*YY+R(3,3)*ZZ+R(3,4)
6650NEXT I%
6660ENDPROC
7000REM drawit
7010DEF PROCdrawit
7020LOCAL I%,L1,L2 : CLG
7030FOR I%=1 TO NOV
7039REM put vertices in OBSERVED position, then make
PERSPECTIVE transformation
7040ZZ=R(3,1)*X(I%)+R(3,2)*Y(I%)+R(3,3)*Z(I%)+R(3,4)
7050PMULT=PPD/ZZ
7060XD(I%)=(R(1,1)*X(I%)+R(1,2)*Y(I%)+R(1,3)*Z(I%)+R(
1,4))*PMULT
7070YD(I%)=(R(2,1)*X(I%)+R(2,2)*Y(I%)+R(2,3)*Z(I%)+R(
2,4))*PMULT
7080NEXT I%
7089REM draw lines of scene
7090FOR I%=1 TO NOL
7100L1=LIN(1,I%) : L2=LIN(2,I%)
7110PROCmoveto(XD(L1),YD(L1))
7120PROClineto(XD(L2),YD(L2))
7130NEXT I%
7140ENDPROC
```

Listing 3.

```
6000REMscene3 / consisting of 2 similar objects
6010DEF PROCscene3
6020DIM X(16),Y(16),Z(16),XD(16),YD(16)
6030DIM LIN(2,24),A(4,4),B(4,4),R(4,4)
6040NOV=0 : NOL=0 : PPD=3*VERT
6049REM place first object in SETUP position
6050PROCidR3 : PROCobject
6059REM place second object in a peculiar position
6060PROCidR3
6070PROCrot3(PI/5,1) : PROCmult3
6080PROCrot3(PI/6,2) : PROCmult3
6090PROCtran3(3,2,2) : PROCmult3
6100PROCobject
6109REM specify general rotation
6110PROCidR3 : CLS
6120INPUT"(PX,PY,PZ)",PX,PY,PZ
6130INPUT"(QX,QY,QZ)",QX,QY,QZ
6140INPUT"GAMMA",GAMMA
6150PROCgenrot(PX,PY,PZ,QX,QY,QZ,GAMMA)
6159REM OBSERVED position
6160PROClook3
6169REM draw the scene
6170PROCdrawit
6179REMEOR draw another picture
6180GOTO 6110
6190ENDPROC
```

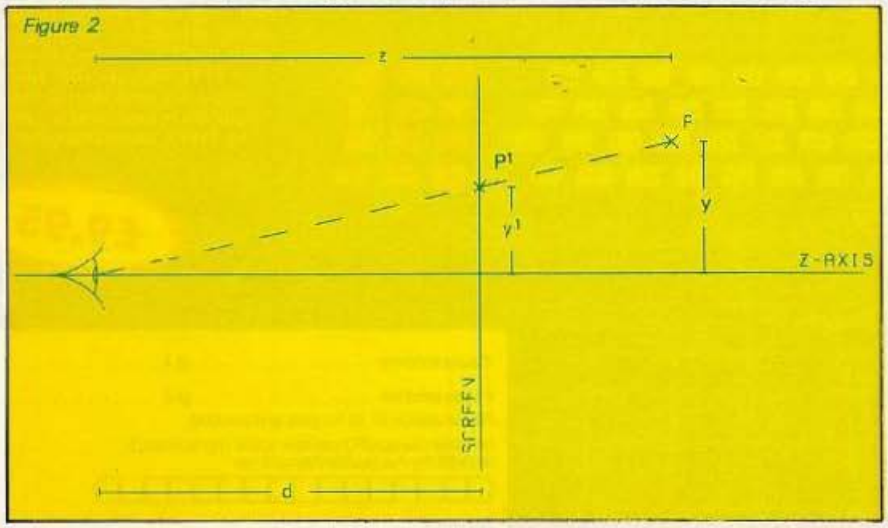
projections of these points onto the near plane are A^1 and B^1, and onto the far plane A^{11} and B^{11}. Note that the projections will have the same shape and orientation, but they will be of different sizes.

We let the perspective plane be a distance d from the eye — variable PPD in later programs. Consider a point $P=(x,y,z)$ in space which sends a ray into the eye. We must calculate the point where this line cuts the view plane — the $z=d$ plane — suppose it is the point $P^1=(x^1,y^1,d)$. Let us first consider the value of y by referring to figure 2. By similar triangles we see that $y^1/d=y/z$, that is $y^1=y.d/z$. Similarly $x^1=x.d/z$. Hence $P^1=(x.d/z,y.d/z,d)$, and we have the x- and y-co-ordinates of the projection on the screen.

Many of the routines needed to draw a perspective view of an object are the same as those required for the orthographic projection. We lump them all together in the library of routines given in listing 1. It contains the routines Start, Setorigin, Moveto, Lineto and Real-to-pixel functions necessary for manipulating the screen of pixels as though it is a window on real 2-D space.

It also contains routines Angle, Rot3, Tran3, Mult3 and IdR3 for manipulating the matrices that represent transformations of 3-D space as well as Genrot which creates a matrix that represents the rotational transformation of space about a general axis, and Look3 which enables the observer to look from any point (EX,EY,EZ) in space toward any other (DX,DY,DZ).

Figure 2



Use of matrices

If you want to understand them fully you must refer back to my previous article or read *Advanced Graphics with the BBC Model B Microcomputer* by I. O. Angell and E. J. Jones — ISBN 0 333 35052 9.

In order to draw a perspective view we must now create a Scene3 routine which calls other routines to calculate a vertex/line data base describing objects in the scene — the setup positions — uses matrices to move each individual object into its actual position in space, and then again to move space into the observed position where the eye is at the origin looking along the positive z-axis, ready for the perspective projection achieved in the

(continued on page 159)

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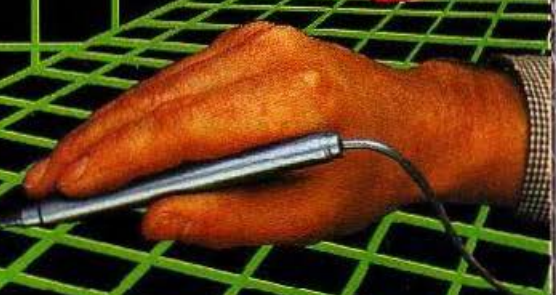

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Listing 4

```
6000REM scene3 / a jet
6010DEF PROCscene3
6020DIM X(74),Y(74),Z(74),XD(74),YD(74)
6030DIM LIN(2,92),A(4,4),B(4,4),R(4,4)
6039REM place JET in SETUP position
6040PROCjet
6049REMEORspecify general rotation
6050PROCidRS : CLS
6060INPUT"(PX,PY,PZ)",PX,PY,PZ
6070INPUT"(QX,QY,QZ)",QX,QY,QZ
6080INPUT"GAMMA",GAMMA
6090PROCgenrot(PX,PY,PZ,QX,QY,QZ,GAMMA)
6099REM OBSERVED position
6100PROClook3
6109REM draw the scene
6110PROCdrawit
6119REM repeat
6120GOTO 6050
6130ENDPROC
6500REM jet
6510DEF PROCjet
6520LOCAL I%
6530DATA 0,0,80,  0,0,64,  0,8,32,  4,8,32,  8,4,32,
8,0,32, 4,-4,32,  0,8,-32, 4,8,-32, 8,4,-32, 8,0,-32,
 4,-4,-32,  0,-4,-32,  8,0,24,  48,0,-32,  8,2,-32,
0,8,0,  2,8,-32,  0,32,-32,  28,-4,-24,  30,-2,-24,  3
2, 2, 24,  34, 4,-24
6540DATA 32,-6,-24,  30,-6,-24,  28,-4,8,  30,-2,8,
32,-2,8,  34,-4,8,  32,-6,8,  30,-6,8,  31,0,-24,  31,
-2,-24,  31,-2,-12,  31,0,-12,  0,6,40,  3,6,40
6550DATA 1,2,  2,3,  2,4,  2,5,  2,6,  2,7,  3,4,  4,
9,  5,10,  6,11,  7,12,  8,9,  9,10,  10,11,  11,12,
12,13,  14,15,  15,10,  15,16,  14,16,  17,18,  17,19,
 18,19
6560DATA 20,21,  21,22,  22,23,  23,24,  24,25,  25,2
0,  26,27.  27,28,  28,29,  29,30,  30,31,  31,26,  20
,26,  21,27,  22,28,  23,29,  24,30,  25,31,  32,33,
33,34,  34,35,  35,32,  36,37
6570RESTORE 6530 : NOV=74 : NOL=92
6579REM SETUP vertices and lines for first side ( X>=
0 )
6580FOR I%=1 TO 37 : READ X(I%),Y(I%),Z(I%) : NEXT I%
6590FOR I%=1 TO 46 : READ LIN(1,I%),LIN(2,I%) : NEXT I%
6599REM SETUP vertices and lines for second side ( X<
=0 )
6600RESTORE 6530
6610FOR I%=38 TO 74
6620READ X(I%),Y(I%),Z(I%) : X(I%)=-X(I%)
6630NEXT I%
6640FOR I%=47 TO 92
6650READ L1,L2
6660LIN(1,I%)=37+L1 : LIN(2,I%)=37+L2
6670NEXT I%
6680ENDPROC
7000REM drawit
7010DEF PROCdrawit
7020LOCAL I%,L1,L2 : CLG
7029REM put in OBSERVED position
7030FOR I%=1 TO NOV
7040ZZ=R(3,1)*X(I%)+R(3,2)*Y(I%)+R(3,3)*Z(I%)+R(3,4)
7050PMULT=PPD/ZZ
7060XD(I%)=(R(1,1)*X(I%)+R(1,2)*Y(I%)+R(1,3)*Z(I%)+R(
1,4))*PMULT
7070YD(I%)=(R(2,1)*X(I%)+R(2,2)*Y(I%)+R(2,3)*Z(I%)+R(
2,4))*PMULT
7080NEXT I%
7089REM draw lines of object
7090FOR I%=1 TO NOL
7100L1=LIN(1,I%) : L2=LIN(2,I%)
7110PROCmoveto(XD(L1),YD(L1))
7120PROClineto(XD(L2),YD(L2))
7130NEXT I%
7140ENDPROC
```

(continued from page 157)

Drawit, routine.

The data base will contain information on NOV vertices — their X,Y and Z values and their projected values XD and YD — and NOL lines. The I'th line joins vertices and indicies LIN(1,I) and LIN(2,I).

The only difference between the program which draws a perspective view and that of the orthographic view is in the calculation of the co-ordinates of the projected image on the screen. Unlike the orthographic, in the perspective projection the co-ordinates on the screen cannot be identified with the x- and y-values of the point in observed position. We need to store the perspective transformation of the vertices in the arrays XD and YD so as not to corrupt the data base for future projections. The I'th vertex (X(I),Y(I),Z(I)) in observed position is projected to (XD(I),YD(I)). The values in arrays XD and YD are given by

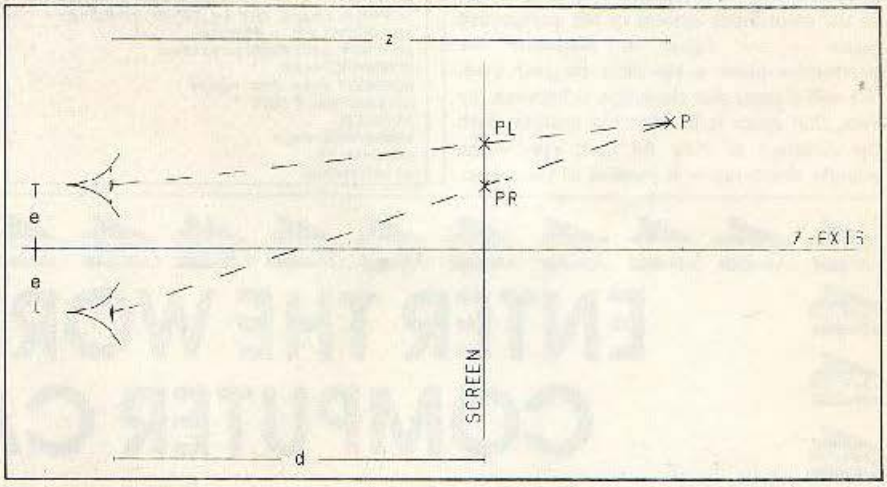
XD(I) = X(I)*PPD/Z(I) and
YD(I) = Y(I)*PPD/Z(I)
for I = 1,2 . . NOV

The value of PPD is set to 3*VERT in Scene3.

We still need to explain our value for PPD. You can see from figure 1 that different values of PPD produce pictures of different sizes — which one do we choose? Is there a correct value. If we consider the practical situation, we note that the observer is sitting in front of a television and the perspective plane is identified with the plane of the T.V. screen. Normally the observer is sitting at a distance which is about three times the height of the screen from the terminal.

In the scale of our mapping from the real-world to the graphics area of pixels, this is a distance 3*VERT. If we choose PPD greater than this value it is as though we are creating a close up, and if PPD is less than 3*VERT we get the smaller image of a long shot.

If you merge listing 2 with listing 1 you get program 1 which, when run in Mode 4, draws a perspective view of a cube. Try HORIZ = 1, (EX,EY,EZ)=(10,0,0) and (DX,DY,DZ)=(0,0,0). Here we are viewing the wire cube from the front but note that, unlike the orthographic projection, the back face of the cube is smaller in projection than the front face and that lines parallel on the 3-D cube need no longer be parallel in projection: in fact they meet at a vanishing point.



Now choose (EX,EY,EZ)=(20,0,0) ie., the observer is still looking at the cube from the same direction, but from further away: see how the projection is the same shape and orientation as previously but it has diminished in size, as you would expect with perspective! If you now return program 1 with the same values of (EX,EY,EZ) and (DX,DY,DZ) but with HORIZ = 100 you will see that a change in the size of HORIZ makes no difference to the perspective projection! So you can keep a value of HORIZ=1 for all perspective projections.

Now run the program with (EX,EY,EZ) = (.,0,0). It will fail. The eye of the observer lies in one edge of the cube, and the perspective transformation leads to a division by zero. Theoretically, objects may be positioned throughout space, even behind the eye, however to avoid problems we only consider points with positive z-co-ordinates in the observer position.

Now run program 1 with general values of (EX,EY,EZ) and (DX,DY,DZ) eg., (10,20,30) to (0,0,0) : (5,10,15) to (0,0,0) : (5,10,15) to (1,1,1) etc.

Listing 3 should be merged with listing 1 and the Object and Drawit routines of listing 2, to form program 2 which runs in Mode 4. It gives a general perspective view of a scene consisting of two cubes that can be rotated by an angle Gamma about an axis of rotation which joins point (PX,PY,PZ) to (QX,QY,QZ).

Program 3 is formed by merging listing 4 with listing 1 and the Drawit routine of listing 2. When run in mode 4 it draws a perspective view of a jet. Try HORIZ = 1, (PX,YP,PZ)=(1,1,1), (QX,QY,QZ)=(0,0,0), GAMMA = 1 with (EX,EY,EZ) = (200,300,400) and (DX,DY,DZ)=(0,0,0). Then try (EX,EY,EZ)=(300,400,500) etc.

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Perspective views are all very well but we have two eyes. Each eye should have its own perspective view, which will differ slightly from that of the other eye. This is the means by which we appreciate the three-dimensional quality of our world.

This leads to a problem; we cannot simply draw two such projections because the left eye will not only see the view created for it, but also that made for the right eye, and vice versa. To stop this confusion we must ensure that each eye sees its own view, but only its view. This is achieved by using a pair of stereoscopic spectacles: a pair of transparent plastic sheets, one red — left eye — and one blue — right eye. In this way the left eye cannot see red lines because they appear the same colour as the white background.

Similarly for the right eye which cannot see blue lines, but red lines look black. So the computer must make two line drawings of a scene: one in blue for the left eye, and one in red for the right eye: hence we have to run using Mode 1 logically Anding the colours — GCol 2 — onto a white background.

So we wish to devise a method of producing the stereoscopic projection of a general point $P=(x,y,z)$, that is two points $PL=(x_l,y_l)$ for the left eye and $PR=(x_r,y_r)$ for the right eye, in the co-ordinate system of the perspective plane — see figure 3. Naturally the perspective plane is the same for both eyes. We will assume that the origin is between the eyes, that space is in observed position with the direction of view for each eye — the straight ahead ray — is parallel to the z-axis.

Listing 5.

```
7000REM drawit
7010DEF PROCdrawit
7020LOCAL I%,J%,L1,L2 : CLG
7030VDU19,2,4,0,0,0
7040ED=VERT*0.2 : GCOL 2,2
7049REMDraw figure twice :- first the view from th
eLINEright eye then the view from theDIVleft eye
7050FOR J%=1 TO 2
7060FOR I%=1 TO NOV
7069REM put vertices in OBSERVED position, then make
PERSPECTIVE transformation
7070Z=R(3,1)*X(I%)+R(3,2)*Y(I%)+R(3,3)*Z(I%)+R(3,4)
7080PMULT=PPD/Z
7090XC(I%)=(R(1,1)*X(I%)+R(1,2)*Y(I%)+R(1,3)*Z(I%)+R(
1,4)*ED)*PMULT-ED
7100YC(I%)=(R(2,1)*X(I%)+R(2,2)*Y(I%)+R(2,3)*Z(I%)+R(
2,4))*PMULT
7110NEXT I%
7119REM draw lines of scene
7120FOR I%=1 TO NOL
7130L1=LIN(1,I%) : L2=LIN(2,I%)
7140PROCmovetoXD(L1),YD(L1)
7150PROClinetoXD(L2),YD(L2)
7160NEXT I%
7169REM next eye
7170ED=-ED : GCOL 2,1
7180NEXT J%
7190ENDPROC
```

The eyes have co-ordinates $(-e,0,0)$, left, and $(e,0,0)$, right: in the program that follows, e is given by variable ED, which is normally about 0.2*VERT. Again the perspective view plane is a distance d — variable PPD — from the origin. In order to find PL we move space by $(e,0,0)$ so that P becomes $(x+e,y,z)$ and the perspective transform of this point for the left eye is $((x+e).d/z,y.d/z)$, which when we return space to its original position becomes

Listing 6.

```
6000REM scene3 / a jet
6010DEF PROCscene3
6020DIM X(74),Y(74),Z(74),XD(74),YD(74)
6030DIM LIN(2,92),A(4,4),B(4,4),R(4,4)
6039REM place JET in SET UP position
6040PROCldR3 : PROCjet
6049REM OBSERVED position
6050PROClook3
6059REM draw the scene
6060*SPOOL PICCY
6070CLG
6080PROCdrawit
6090*SPOOL
6100ENDPROC
```

$((x+e).d/z-e,y.d/z)$. Similarly, the right eye transformation produces $PR=((x-e).d/z+e,y.d/z)$.

Listing 5 is a Drawit routine which, when used as a replacement in our first two programs, draws a stereoscopic view of the cube — program 1 — or pairs of cubes — program 2.

For the best stereoscopic views it is best to make the perspective plane cut on the object being viewed i.e., if $(DX,DY,DX)=(0,0,0)$ then make $\sqrt{(EX^2+EY^2+EZ^2)}=PPD$ $(=3*VERT)$. Therefore in the case of stereoscopic views we cannot keep HORIZ — and VERT — fixed, since for the best projections HORIZ and VERT depends on (EX,EY,EZ). For program 4, formed in the above-mentioned way from program 1, try HORIZ = 10, $(EX,EY,EZ)=(8,12,16)$ and $(DX,DY,DZ)=(0,0,0)$.

If you replace the Scene3 of program 3 — the jet — with listing 6, and also use Drawit — listing 5 — you get program 5 for drawing a stereoscopic picture of the jet. There is not enough memory to run the program in mode 1, so instead we run in mode 7, and the program *Spools the picture onto file Piccy in backing store. Then if you clear the old program and *Exec Piccy onto a white mode 1 screen you will get your stereoscopic picture. A good result is achieved with HORIZ = 230, $(EX,EY,EX)=(250,300,350)$ and $(DX,DY,DZ)=(0,0,0)$. Type

```
NEW
MODE 1 : VDU 23 1,0;0;0;0;
GCOL 0,135 : CLG
*EXEC PICCY
```


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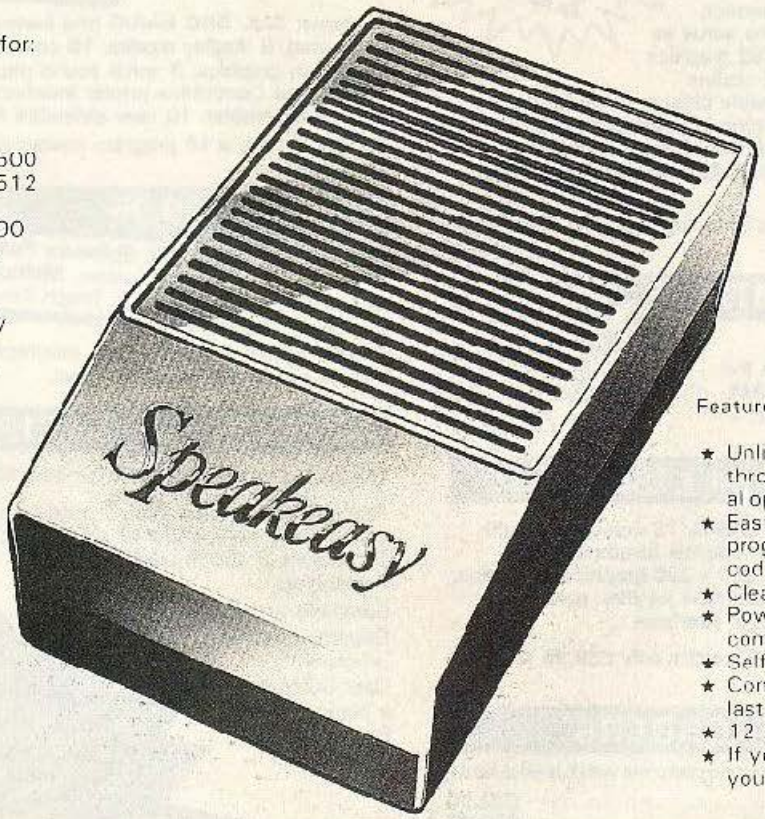

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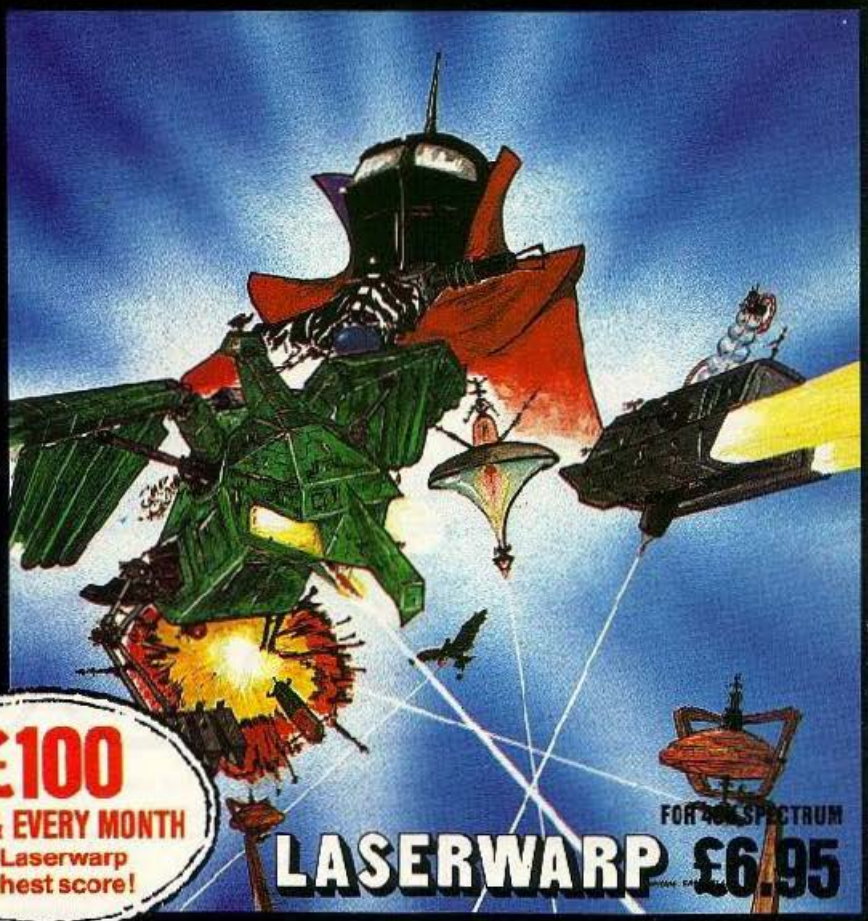

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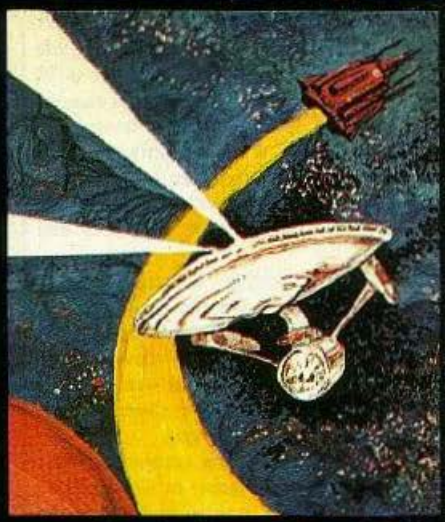

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John Ransley completes his mini-series on adventure program writing.

ZAGORSK

IF YOU READ last month's article and entered the sample program, you will now have spent nearly a month traipsing around the crypts of Zagorsk Monastery looking for that elusive ikon. I promise that it gets more interesting from now on in.

Our sample adventure is based on a grid six squares by six, giving a total 36 possible locations, numbered 1 to 36 — not zero to 35 as shown in last month's feature, for reasons I'll explain later. Each square has the name of the location found at that position, with a notional one-way or two-way arrow or no arrow at all linking it with any adjoining box(es) to indicate possible entrances and exits.

The sample location descriptions and movement data given last month is reflected in lines 7010 to 8415 of the full listing. The eagle-eyed will notice that I have altered slightly legal moves into and out of some locations to make it a little easier for the novice to move around the grid.

You may now enter the complete listing (which should make sense to any micro's dialect of Basic) from start to finish and start playing. But if you want to understand the mechanics of the program, you may prefer to tackle the listing in little chunks or modules, which I'll describe and explain how to test as you go along.

Begin by entering lines 1170, 1180, 1400 to 1450 inclusive and 7010 to 8415 inclusive. As a short cut, you can spare yourself some typing by using just token descriptions — for example, Tsars' Tomb, St Petrie — instead of those I've suggested. On the other hand, you may like to start improving on my efforts by expanding on the descriptions to the limits of your imagination.

When you have finished entering all those lines, check your descriptions for awkward line breaks, spelling mistakes and general screen presentation. To do so, simply type Run X, where X is the description's line number, and hit Return. Give special care to entering lines 1400 and 1450. Each of them offers a signpost to one horizontal row of six locations. Here is how they work:

Your current position or CP is set at location 23 — line 1170 — at the start of every new game. That value is then tested by lines 1400 to 1420 in this way. As it is not any of the locations numbered 1 to 18, you drop through lines 1400 to 1420 and come to rest at 1430; CP is less than 25 but not less than 19. Most micros' Basic need a minimum value of 1 for On Goto commands, which is why I dropped the zero when re-numbering the grid.

The program branches

In this particular case, the On Goto routine expects a value from 1 to 6, so 18 is deducted from CP to provide a number in that range. Line 1430 ends its work by counting five places along the queue of description line numbers to arrive at 8170 — and it is to that line number which the program now branches.

You can check that all 36 locations are properly signalled in that way by charging CP to values from 1 to 36 in turn. Do not worry about the error message you will get when Running a test on location 33.

Now we can fill some of those 36 locations with objects — a few of which you will need to overcome challenges and find the ikon. Line 1016 reserves space for three arrays each containing 12 elements — we want to site 12 objects. The numeric array PL% will hold the numbers of the squares where the objects will always be found when a new game begins — their (P)rimary (L)ocations. The first string array, SN$ stores the objects' short names. The second string array, LN$, holds their long names.

On the first pass through the loop in 1022 and 1024, X fills those three arrays with the three data items in line 1030 in turn. The loop repeats the process 11 times. After entering lines 1022 to 1140, test the procedure by typing in direct mode:

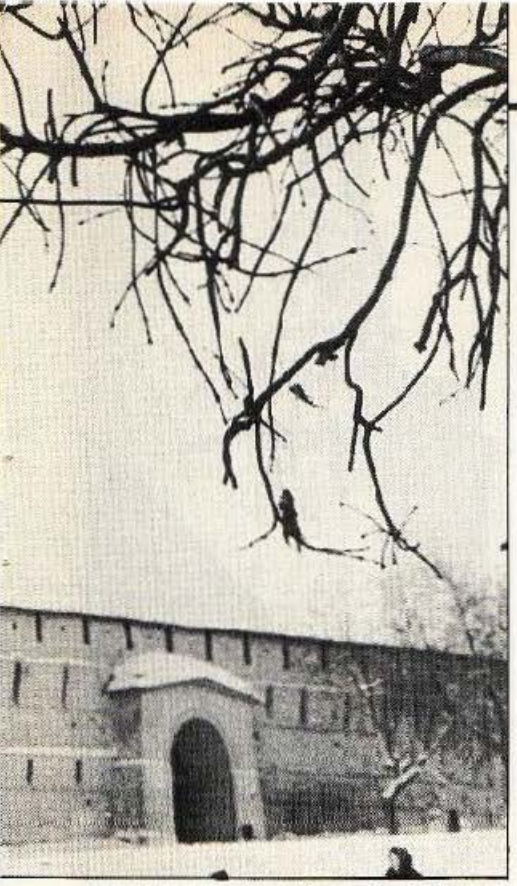
```
PRINT PL%(1):PRINT SN$(1):PRINT LN$(1)
```

This should generate the screen display:

```
2
ROSARY
A BROKEN ROSARY IS HERE
```

You can run through the remaining 11 values of X to check that each three-piece suite of arrays is properly stuffed. We can now say goodbye to the first section by adding line 1150, which awards a token value of 1 to each of the five variables representing hazards you will encounter in the game. A value of 1 indicates they are active challenges; a value of 0 neutralises.

Lines 1620 to 1640 provide the means of



generating a new line of screen text whenever you enter a location that holds an object. It scans each of the 12 grid positions stored in the array PL% for a match with your current position.

Thus if your CP is 2 — the Chapel of the Tsars — on the very first pass through the loop, PL% will equal 2. This condition triggers screen display of the matching LN$0. In short, it will now read:

YOU ENTER THE CHAPEL OF THE TSARS.
A BROKEN ROSARY IS HERE.

Apart from those 12 objects, this adventure also presents five challenges — one of them, the flood water, is found in two adjoining locations. These are the poisoned water at the drinking fountain, a Nazi in the marble hall, the coin lock protecting the ikon in the sealed chamber, the flood water, and darkness in a gloomy chamber. To conquer each challenge, you will need to be carrying a particular object when you encounter it.

We have already given each challenge variable a value of 1 in line 1016. That being so, lines 1680 to 1730 check your current location and the status of any challenge that exists there. Remember that challenges remain in the same location throughout the game — at least until you conquer them — whereas any object can be taken from location to location — and left at one different from that at which it was found.

If a challenge does exist, control passes to line 8440 to 8480 depending on the peril: we will deal with that module later. If no challenge exists, you can move to another location, and lines 1760 to 1810 calculate and display your options. Line 1840 adds some screen space — CHR$(13) is a carriage return — before 1850 invites your response.

The main input routine starts here. You must use the letter N, S, E or W and Return to move. If you try this ploy with an active challenge present, lines 2010 to 2060 speed you off to the wrist-slapping routine in lines 2250 to 2270. Otherwise, line 2110 gives the go-ahead and one of the four possibilities in 2150 to 2180 will act on your choice, calculating your (N)ew (P)osition and looping back to 1200 to update your revised CP.

But say you do not enter N, S, E or W? The instruction I will call your inventory, to show what objects if any you are currently carrying. The H is for help; using it may give you a clue. Press Q if you get thoroughly fed up and want to quit the game.

When you reach a challenge location, you can only survive, escape, find the ikon or whatever by having with you the right object and using the correct command. Lines 2400 to 2435 specify what those commands must be

Qualifier controls use

The CP qualifier in each line controls their use in the right location but in challenge and any other locations, you may want to try commands of your own. Central to an adventure is the player's freedom to acquire, and perhaps later jettison, the objects he finds along the way. The commands allowing this usually take the form of a two-word sentence comprising one verb and one noun. For example:

TAKE ROPE
GET CANDLES
DROP ROSARY
LEAVE SCROLL

Lines 2460 to 2840 walk through each such command, searching for the space which separates the two. If one cannot be found — suggesting that one word, not two, has been entered — control passes to line 2490. Otherwise, lines 2530 to 2570 get to work on splitting the two-word command into a verb string and noun string, naming the word to the left of the space VE$ and that to the right NO$.

Lines 2600 to 2630 then check VE$ for verbs recognised. You can have any number you like up to your micro's maximum line length, and even then you can always spill over into additional lines. For example, you could add STEAL, GRAB or PICK; DUMP, ABANDON or LOSE: and SLAY, CONQUER or SHOOT as additions to lines 2600, 2610 and 2620 respectively. Line 2650 takes care of any verb outside the VE$ dictionary.

When you Take or Get any object — or dispose of it — you'll want the Inventory to reflect that fact. The routine contained within lines 2670 to 2720 does that for you. Likewise, any call for help will pass control to lines 2750 to 2800, to display any clue available in respect of your current location.

The Get and Drop functions are probably the most important in any adventure program and although you are welcome to adopt unquestioningly the routines in lines 2830 to 2890 and 3020 to 3070 respectively, you will find that they repay a little study.

Line 2830 sets up a (G)et loop which will check out the 12 possible objects; line 2840 actually makes the comparison between the object(s) found at your current position and the object you want to take. If there is a match then that location is given a negative value (−1) only in respect of the object you now carry. It is safe to use −1 because it is a distinctive value — often used, for example, to signal the end of a Data queue — which

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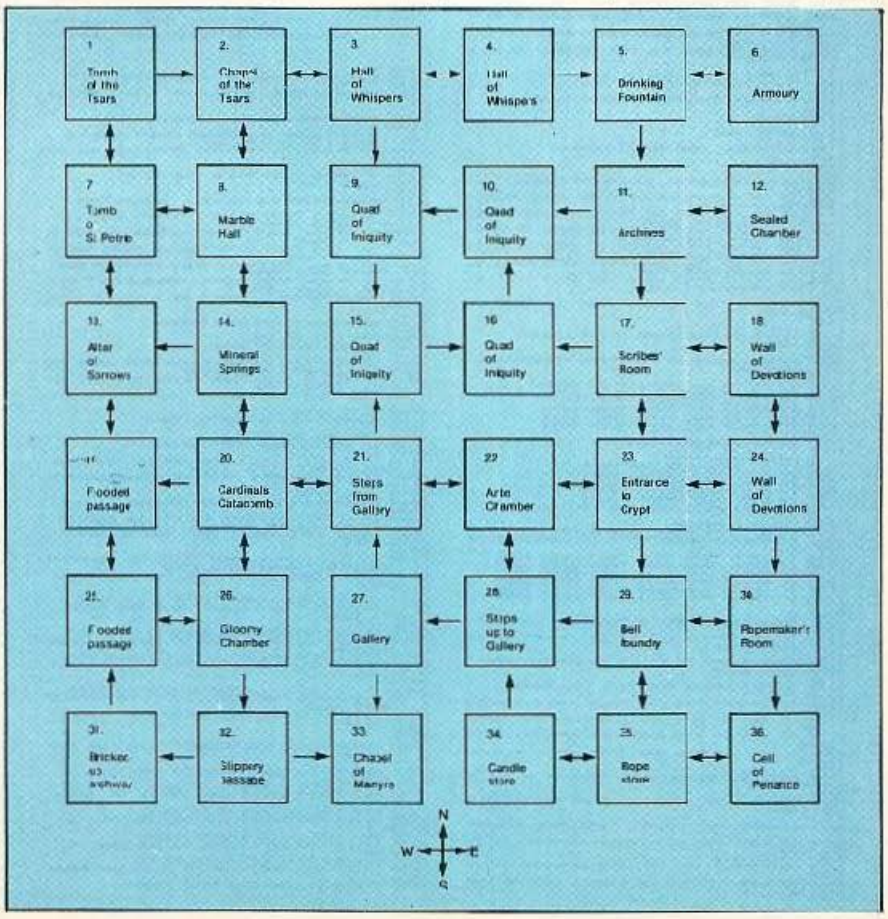
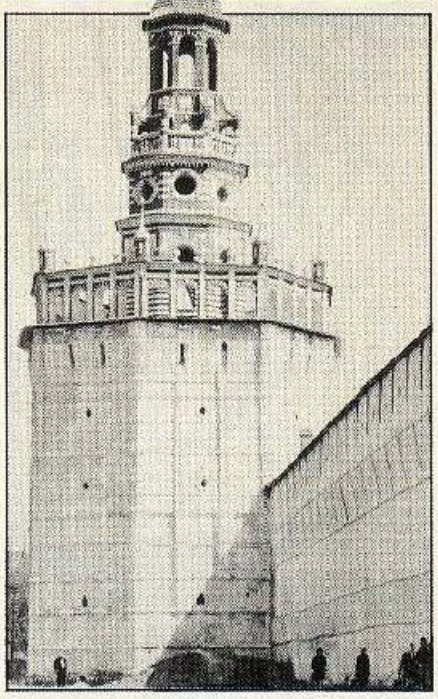


Variables.

PL	Primary location.	S	South.
SN$	Short name string.	E	East.
LN$	Long name string	W	West.
PW	Poisoned water.	I$	Instructions input string.
NZ	Nazi.	I	Inventory.
CL	Coin lock.	H	Help.
FW	Floodwater.	Q	Quit.
DK	Darkness.	SP	Space between noun and verb.
CP	Current position.	VE$	Verb string.
N	North.	NO$	Noun string



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cannot be confused with any other variable.

If the location is one where a −1 flag already exists in respect of the object you wish to take, then it means you carry it already, and line 2860 announces the fact. Or if you try to Get an object that is not at that location anyway, line 2870 does its bits. Otherwise, 2890 will confirm your selection. Enter I and Return now and you will see that your inventory has been appropriately updated.

Lines 3020 to 3075 perform the same function in reverse in response to Drop or Leave, testing in line 3050 for a value other than −1.

You will remember that your success in overcoming any and all of the five special challenge depends on being in possession of the right objects at the right locations and using them properly. Lines 5010 to 5200 monitor the relevance of the objects you carry to the location you have reached.

If you do well, then the matching status flag — PW=1, NZ=1 and so on — is neutralised with a value of 0 and you are allowed to move on. Neutralising the challenge also means that you are allowed to move on. Neutralising the challenge also means that you will not encounter it again if you return to that same location later. If you fail, you will either find yourself trapped or despatched to the play again routine in lines 9005 to 9060.

```
1000 REM****THE ST PETERSBURG ILON ****
1002
1003 REM****WRITTEN FOR YOUR COMPUTER***
1004
1005 REM***COPYRIGHT 1984 JOHN RANSLEY**
1006
1014 REM***SET UP OBJECT ARRAYS***
1015
1016 DIM PL(12),SN$(12),LN$(12)
1017
1018 REM***FILL OBJECT ARRAYS***
1020
1022 FOR X=1TO12:READ PL(X),SN$(X),LN$(
X)
1024 NEXT
1025
1028 REM***DATA FOR OBJECT ARRAYS***
1030
1039 DATA 2,ROSARY,A BROKEN ROSARY IS HE
RE.
1040 DATA 6,CAP,YOU FIND A BRITISH OFFIC
ER'S CAP.
1050 DATA 11,SCROLL,AN ILLUMINATED SCROL
L IS HERE.
1060 DATA 13,DAGGER,A NAZI DAGGER IS AT
YOUR FEET.
1070 DATA 7,PRAYER BOOK,YOU NOTICE AN O
PEN PRAYER BOOK.
1080 DATA 18,COINS,A FEW COINS ARE SCATT
ERED AROUND.
1090 DATA 20,ELIXIR,A BOTTLE OF HERBAL E
LIXIR LIES HERE.
1100 DATA 27,KEYS,YOU DISCOVER AN OLD BU
NCH OF KEYS.
1110 DATA 29,TOOLS,SOME OLD TOOLS ARE WI
THIN REACH
1120 DATA 31,CIGAR LABEL,YOU SPOT A BUTC
H CIGAR LABEL.
1130 DATA 34,CANDLES,A FEW UNUSED CANDLE
S SPRAWL HERE.
1140 DATA 35,ROPE,YOU NOTICE SOME OLD LE
NGTHS OF ROPE
1142
1145 REM***SET STATUS OF CHALLENGES***
1150 PW=1:NZ=1:CL=1:FW=1:DK=1
1155
1158 REM***SET CURRENT POSITION***
1159
1170 CP=20
1175
1180 GOTO 1480
1185
1190 REM***SET NEW POSITION***
1195
1200 CP=NP
1205
1208 REM***SIGNPOST TO LOCATION***
1209
1210 IF CP<7 THEN ON CP GOTO 7310,7020,7
030,7040,7050,7060
1410 IF CP<13 THEN ON CP-6 GOTO 8010,802
0,8030,8040,8050,8060
1420 IF CP<19 THEN ON CP-12 GOTO 9070,90
80,9090,9100,9110,9120
1430 IF CP<25 THEN ON CP-18 GOTO 9130,91
40,9150,9160,9170,9180
1440 IF CP<31 THEN ON CP-24 GOTO 9200,92
20,9230,9240,9250,9260
1450 IF CP<37 THEN ON CP-30 GOTO 9280,93
00,9310,9320,9330,9340
1455
1460 REM***PRINT OBJECT NAME IN RIGHT LO
CATION***
1470
1475 FOR X=1 TO 12
1480 IF PL(X)=CP THEN PRINT LN$(X)
1485 NEXT
1490
1495 REM***CHECK IF LOCATION PRESENTS A
CHALLENGE***
1500
1505 IF CP= 5 AND PW=1 THEN 8440
1510 IF CP= 8 AND NZ=1 THEN 8450
1515 IF CP=12 AND CL=1 THEN 8460
1520 IF CP=19 AND FW=1 THEN 8470
1525 IF CP=25 AND FW=1 THEN 8470
1530 IF CP=26 AND DK=1 THEN 8480
1535
1540 REM***DISPLAY POSSIBLE MOVES***
1545
1550 PRINT CHR$(13)
1555 PRINT "YOU MAY NOW MOVE ";
1560 IF N>0 THEN PRINT "NORTH ";
1565 IF S>0 THEN PRINT "SOUTH ";
1570 IF E>0 THEN PRINT "EAST ";
1575 IF W>0 THEN PRINT "WEST ";
1580 REM***INPUT NEW INSTRUCTION***
1585
1590 PRINT CHR$(13)
1595 PRINT"WHAT NOW?":INPUT I$
2000 REM***HERE BLOCK MOVE IF CHALLENGE E
XISTS***
2010 IF CP=5 AND PW=1 THEN GOTO 2300
2020 IF CP=8 AND NZ=1 THEN GOTO 2350
2030 IF CP=12 AND CL=1 THEN GOTO 2350
2040 IF CP=19 AND FW=1 THEN GOTO 2350
2050 IF CP=25 AND FW=1 THEN GOTO 2350
2060 IF CP=26 AND DK=1 THEN GOTO 2350
2070
2080
2090 REM***UPPER KEY ENTERED***
2100
2110 IF I$="N" OR I$="S" OR I$="E" OR I$
="W" THEN 2190
2115
2120 REM***JUMP TO OTHER IF OPTIONS***
2130 GOTO 2320
2135
2140 REM***CHANGE POSITION VARIABLE***
2145
2150 IF I$="N" AND N>0 THEN NP=CP-6:GOTO
1200
2160 IF I$="S" AND S>0 THEN NP=CP+6 GOTO
1200
2170 IF I$="E" AND E>0 THEN NP=CP+1 GOTO
1200
2180 IF I$="W" AND W>0 THEN NP=CP-1 GOTO
1200
2190
2200 REM***BLOCK ILLEGAL MOVE IF N.S.E O
R W = 0***
2210
2230 PRINT "YOU CAN'T.":PRINT CHR$(13) G
OTO 1200
2235
2240 REM***BLOCK ESCAPE FROM CHALLENGE***
2250 IF I$="N"OR I$="S"OR I$="E"OR I$="W"TH
EN 2270
2260 GOTO 2320
2270 PRINT"NOT YET YOU DON'T!" GOTO 1840
2300
2310 REM***CHECK OTHER SINGLE LETTER INP
UTS***
2315
2320 IF I$="I" THEN 2570
2325 IF I$="H" THEN 2750
2330 IF I$="Q" THEN 9005
2335
2340
2345
2350 REM***CHECK FOR SPECIAL COMMANDS***
2360
2365 IF I$="SWALLOW ELIXIR" AND CP=5 THE
N 2370
2370 IF I$="STRANGLE NAZI" AND CP=8 THEN
2375
2380 IF I$="INSERT COINS" AND CP=12 THEN
2390
2430 IF I$="WASH WATER" AND CP=19 OR CP=
25 THEN 2490
2435 IF I$="LIGHT CANDLES" AND CP=26 THE
N 2440
2445
2450 REM***SCAN TWO-WORD COMMAND***
2455
2460 FOR W=1 TO LEN(I$)
2475 IF MID$(I$,W,1)=" " THEN 2530
2480 NEXT W
2485 PRINT"YOU MUST USE TWO WORDS":GOTO
1840
2500
2510 REM***SPLIT VERB AND NOUN***
2520
2530 FOR SP=1 TO LEN(I$)
2540 IF MID$(I$,SP,1)=" " THEN 2560
2550 NEXT SP
2555 VE$ = LEFT$(I$,SP-1)
2560 NO$ = RIGHT$(I$,LEN(I$)-SP)
2570
2580 REM***SCAN VERB FOR RECOGNISED COMMA
NDS***
2590
2600 IF VE$="GET" OR VE$="TAKE" THEN 203
0
2610 IF VE$="DROP" OR VE$="LEAVE" THEN 3
020
2630
2640 REM***IF VERB NOT RECOGNISED***
2650
2660 PRINT"SORRY, YOU CAN'T ";I$ GOTO 18
40
2670
2680 REM***MAKING THE INVENTORY***
2690
2700 PRINT"YOUR INVENTORY COMPRISES -"
2705 FOR X=1 TO 12
2710 IF PL(X)= -1 THEN PRINT SN$(X);IN
T(X+1)
2720 NEXT X
2725 IF I=0 THEN PRINT "NOTHING"
2730 GOTO 1750
2735
2740 REM***RESPOND TO HELP REQUEST***
2745
2750 IF CP=5 THEN PRINT "DRINK ELSE TO
DRINK" GOTO 1840
2760 IF CP=19 THEN PRINT"CHANGE IN THE S
TRUTTER" GOTO 1840
2770 IF CP=8 THEN PRINT"HOOSE FROM THE P
ROMPT" GOTO 1840
2780 IF CP=19 OR CP=25 THEN PRINT"A BAD
WORKMAN" GOTO 1840
2790 IF CP=25 THEN PRINT "SOME LIGHT MIG
HT HELP." GOTO 1840
2800 PRINT"SORRY - CANNOT HELP YOU."GOTO
1840
2810
2820 REM***GETTING OBJECTS***
2825
2830 FOR X=1 TO 12
2840 IF SN$(X)=NO$ THEN 2860
2850 NEXT
2860 IF PL(X)=-1 THEN PRINT"YOU HAVE GO
TTEN ";LN$(X);" ALREADY.":GOTO 1750
2870 IF PL(X)=CP THEN PRINT SN$(X);" NO
T HERE.":GOTO 1750
2880 PRINT"YOU'VE TAKEN ";SN$(X);PL(X)=
-1
2890 GOTO 1750
3000 REM***DROPPING OBJECTS***
3010
3020 FOR L=1 TO 12
3030 IF SN$(L)=NO$ THEN 3050
3040 NEXT
3050 IF PL(L)<> -1 THEN PRINT "YOU DON
'T HAVE ";SN$(L):GOTO 1750
3060 PRINT"YOU HAVE DROPPED ";SN$(L);PL(
L)=CP
3070 GOTO 1750
3080
3090 REM***CHALLENGE ROUTINES***
3095
3010 IF PL(5)=-1 THEN PRINT"THE ELIXIR
WORKS.":FW=0:GOTO 1750
3020 PRINT "YOU DON'T HAVE THE ELIXIR."
3070 GOTO 1750
3075
3080 IF PL(16)=-1 THEN PRINT"HE SLUMPS
UNCONSCIOUS.":NZ=0:GOTO 1750
3040 PRINT "YOU DON'T HAVE THE ROPE":GOT
O 3005
3045
3050 IF PL(3)=-1 THEN CL=0:GOTO 8510
3060 PRINT"BUT YOU DON'T HAVE THE COINS.
":GOTO 1840
3065
3070 IF PL(3)=-1 THEN 5090
3075 PRINT"YOU HAVE SWUM TO SAFETY.":FW=
0:GOTO 1750
5080 PRINT"THE WEIGHT OF THE TOOLS DRAG"
5081 PRINT"YOU UNDER AND YOU DROWN!":GOT
O 9005
5085
5090 IF PL(3)=-1 THEN DK=0:GOTO 5100
5100 PRINT"BUT YOU DON'T HAVE THE CANDLE
S":GOTO 1840
5190 PRINT"YOU CAN SEE AHEAD NOW.":DK=0:
GOTO 1750
5195
7000 REM***LOCATION DESCRIPTIONS AND EXI
TS***
7005
7010 PRINT"YOU HAVE REACHED THE TOMB OF
THE TSARS."
7015 N=0:S=7:E=2:W=0:GOTO 1620
7020 PRINT"YOU ENTER THE CHAPEL OF THE T
SARS."
7025 N=0:S=8:E=3:W=0:GOTO 1620
7030 PRINT"YOU HAVE COME TO THE HALL OF
WHISPERS."
7035 N=0:S=9:E=4:W=2:GOTO 1620
7040 PRINT"YOU HAVE COME TO THE HALL OF
WHISPERS."
7045 N=0:S=9:E=5:W=3:GOTO 1620
7050 PRINT"YOU ARRIVE AT A DRINKING FOUN
TAIN."
7055 N=0:S=11:E=6:W=0:GOTO 1620
7060 PRINT"HERE IS EVIDENCE OF AN OLD ARMORY."
7065 N=0:S=0:E=0:W=0:GOTO 1620
8010 PRINT"HERE IS THE SILENT TOMB OF ST. PETRIE."
8015 N=1:S=13:E=0:W=0:GOTO 1620
8020 PRINT"YOU WONDER INTO A VAST MARBLE HALL."
8025 N=20:S=14:E=0:W=7:GOTO 1620
8030 PRINT"YOU TREAD THE QUAY OF ANTIQUITY."
8035 N=0:S=15:E=0:W=0:GOTO 1620
8040 PRINT"YOU TREAD THE QUAY OF ANTIQUITY."
8045 N=0:S=0:E=0:W=9:GOTO 1620
8050 PRINT"DUST-DRAPED ARCHIVES LIE BEFORE YOU."
8055 N=5:S=17:E=11:W=10:GOTO 1620
8060 PRINT"YOU STAND BEFORE A SMALL CHAMBER."
8065 N=0:S=0:E=0:W=11:GOTO 1620
8070 PRINT"YOU PAUSE AT THE ALTAR OF SORROWS."
8075 N=7:S=19:E=0:W=0:GOTO 1620
8080 PRINT"THE CRYSTAL WATERS OF A MINERAL"
8081 PRINT"SPRING BUBBLE FROM THE GROUND."
8085 N=0:S=20:E=0:W=13:GOTO 1620
8090 PRINT"YOU TREAD THE QUAY OF ANTIQUITY."
8095 N=0:S=0:E=16:W=0:GOTO 1620
8100 PRINT"YOU TREAD THE QUAY OF ANTIQUITY."
8105 N=10:S=0:E=0:W=0:GOTO 1620
8110 PRINT"YOU WANDER IN A DESERTED SCRIBES' ROOM."
8115 N=11:S=23:E=18:W=16:GOTO 1620
8120 PRINT"YOU WALK ALONG THE WALL OF DEVOTIONS."
8125 N=0:S=24:E=0:W=17:GOTO 1620
8130 PRINT"A FLOODED PASSAGE LIES BEFORE YOU."
8135 N=13:S=25:E=0:W=0:GOTO 1620
8140 PRINT"YOU ENCOUNTER SOMETHING THAT WEAR
S"
8145 N=14:S=26:E=21:W=19:GOTO 1620
8150 PRINT"YOU SEE STEPS DOWN FROM THE GALLERY."
8155 N=15:S=0:E=22:W=20:GOTO 1620
8160 PRINT"YOU ENTER A TINY ANTE-CHAMBER."
8165 N=0:S=20:E=23:W=21:GOTO 1620
8170 PRINT"YOU ARE NOW AT THE ENTRANCE TO THE"
8171 PRINT"CRYPTS OF ZADOZOK MONASTERY."
8175 N=17:S=29:E=24:W=22:GOTO 1620
8180 PRINT"YOU WALK ALONG THE WALL OF DEVOTIONS."
8185 N=18:S=30:E=0:W=23:GOTO 1620
8190 PRINT"A FLOODED PASSAGE LIES BEFORE YOU."
8195 N=19:S=0:E=26:W=0:GOTO 1620
8200 PRINT"YOU STUMBLE INTO A GLOOMY CHAMBER."
8205 N=20:S=32:E=0:W=25:GOTO 1620
8210 PRINT"FROM THIS GALLERY, YOU CAN ONLY SEE"
8211 PRINT"TWO FLIGHTS OF STONE STEPS."
8215 N=21:S=33:E=0:W=0:GOTO 1620
8240 PRINT"YOU GLIMPSE STEPS LEADING TO A GALLERY."
8245 N=22:S=0:E=0:W=27:GOTO 1620
8250 PRINT"YOU ENTER A DISUSED BELL FOUNDRY."
8255 N=0:S=35:E=28:W=29:GOTO 1620
8260 PRINT"BELL MOULDS WERE ONCE MADE IN THIS ROOM."
8265 N=0:S=36:E=0:W=29:GOTO 1620
8270 PRINT"A BRICKED-UP ARCHWAY COMES INTO VIEW."
8275 N=25:S=0:E=0:W=0:GOTO 1620
8280 PRINT"THE GROUND IS CLIMBING HERE."
8285 N=0:S=0:E=33:W=31:GOTO 1620
8340
8345 REM***SPECIAL PERIL ROUTINE***
8350
8360 PRINT"A BAD CHOICE...YOU'VE TRESPASSED INTO"
8361 PRINT"THE CHAPEL OF TRAITORS, WHERE SCREAMING"
8362 PRINT"DEMONS ERE MY YOUR FLESH"
8363 PRINT"WITH THE RED-HOT SPIKES UPON WHICH"
8364 PRINT"THEY WERE IMPALED WHEN EXECUTED."
8365
8366 REM***DROP OUT OF PROGRAM***
8367
8368 GOTO 9005
8370
8380 PRINT"THIS PLACE IS JUST THE CANDLE STORE."
8385 N=28:S=0:E=0:W=0:GOTO 1620
8390 PRINT"THIS IS THE SITE OF THE OLD ROPE STORE."
8395 N=29:S=0:E=0:W=34:GOTO 1620
8410 PRINT"YOU ENTER THE TINY CELL OF PENANCE."
8415 N=0:S=0:E=0:W=35:GOTO 1620
8420
8425 REM***PRINT APPROPRIATE CHALLENGE***
8430
8440 PRINT"ALAS! - YOU DRINK SOME POISONED WATER!!" GOTO 1840
8450 PRINT"YOUR HERCULEAN NAZI ADVERSARY POUNCES!!!" GOTO 1840
8460 PRINT"IT HAS A STEEL DOOR WITH A CURIOUS SLOT." GOTO 1840
8470 PRINT"THE WATER IS TO DEEP TO PASS ON FOOT." GOTO 1840
8480 PRINT"IT IS TOO DARK TO SEE ANYTHING." GOTO 1840
8490
8500 REM***SUCCESS ROUTINE***
8510 PRINT"CONGRATULATIONS!!! YOU HAVE OPENED"
8520 PRINT"THE CHAMBER AND THE DOOR'S"
8530 PRINT"PRICELESS BEAUTY GREETS YOUR GAZE."
8540 PRINT"HOW TO FIND YOUR WAY BACK"
8550 PRINT"SAFELY TO THE CRYPT'S ENTRANCE!!" GOTO 1750
8580
8590 REM***BRAIN-UP SUITABLE***
8595 PRINT CHR$(13)
8610 PRINT"YOU HAVE REACHED THE END OF THIS"
8620 PRINT"ATTEMPT TO FIND THE ST PETERSBURG ILON."
8630 PRINT"WOULD YOU LIKE ANOTHER TRY?"
8640 INPUT I$
8650 IF I$ = "Y" THEN 1150
9000 END

READY.
```

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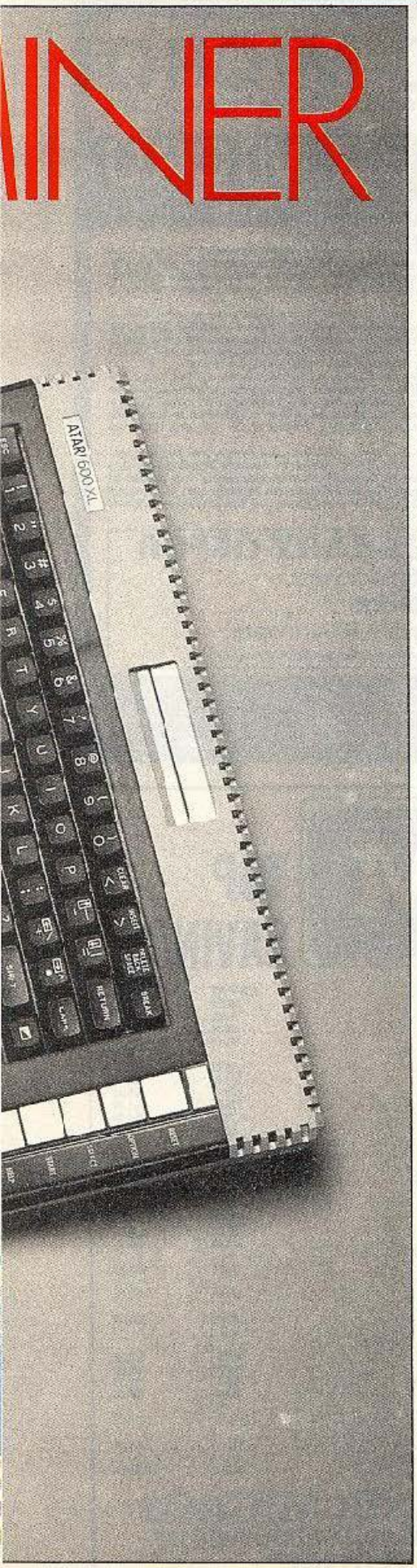
MONSTER M

Frederick Shotton shows you how to be a monster mining mercenary with the help of an Atari.

```
0 POKE 559,0:GOSUB 2000
1 REM ...BY FREDERICK SHOTTON
3 REM ........................
4 REM ...19 WEIDELAAN
5 REM ...1980 TERVUREN
6 REM .....BELGIUM
8 SOUND 0,255,10,8
9 SOUND 1,254,10,8
10 GRAPHICS 1+16
20 POKE 712,0:POKE 708,52
30 POSITION 3,3:? #6;"MONSTER MINER":P
OSITION 2,4:? #6;"----------"
40 POSITION 1,5:? #6;"BY FRED SHOTTON"
49 REM CHANGE CHARACTER SET
50 GOSUB 20000
55 POSITION 1,5:? #6;"
                    "
60 POSITION 1,5:? #6;" X =1":? #6:? #6
;'  Z =50C":? #6:? #6;'  C =750":? #6:
? #6;'  \ =-1 _IFE'
70 ? #6:? #6;'  ] =+50 OXYGEN"
100 POKE 712,248
101 REM LOAD PLAYER MISSILE SUBROUTINE
102 GOSUB 25000:FOR I=0 TO 3:SOUND 1,0
,0,0:NEXT I:POKE 7.2,160:POKE 7.1,255:
REM
103 REM MOST VARIABLES USED IN PROGRAM
104 SC=0:L=3
105 X0=88:Y0=78:X1=103:Y1=159:X2=167:Y
2=63:X3=176:Y3=150:E=1:W=1:U=1:G=0:SOU
ND 0,0,0,0:SOUND 1,0,0,0
106 A=USR(256)
107 IX=9:YY=13:EA=0:VC=8:V2=11:V3=30:V
9=V0-1:V2=V2+1:V3=V3+1:AL0=0:AL1=0:AL2
=0:AL3=0:DX=230:POKE 712,214
108 FOR I=0 TO 3:POKE 53256+I,0:NEXT I
109 REM SET UP SCREEN
110 POKE 708,226:COLOR ASC(CHAR$(5)):F
OR I=0 TO 19:FOR Y=2 TO 19:PLOT I,Y:NE
XT Y:NEXT I:POKE 708,32
120 COLOR 0:PLOT 8,10:DRAWTO 10,10:PLO
T 5,5:DRAWTO 3,7:PLOT 6,16:DRAWTO 6,16
:PLOT 14,4:DRAWTO 16,4:PLOT 16,14:DRAW
TO 14,16
121 REM ......................
122 REM SET MONSTER POSITIONS
123 REM ......................
125 POKE 710,255
126 POKE 77,0
130 POKE PLX,0:POKE PLY,Y0:POKE PLX+1
,X1:POKE PLY+1,Y1:POKE PLX+2,X2:POKE P
LY+2,Y2:POKE PLX+3,X3:POKE PLY+3,Y3
140 COLOR ASC(CHAR$(1))+128:PLOT 9,10
150 GOTO 1000
297 REM ......................
298 REM MOVE MINER
299 REM ......................
300 XE=1:GOSUB 4000:YE=0:COLOR ASC(CHA
R$(1))+128:PLOT X0,YY:RETURN
310 XE=1:GOSUB 4000:YE=0:COLOR ASC(CHA
R$(2))+128:PLOT X0,YY:RETURN
320 XE=1:GOSUB 4000:YE=0:COLOR ASC(CHA
R$(3))+128:PLOT IX,Y1:RETURN
330 YE=1:GOSUB 4000:XE=0:COLOR ASC(CHA
R$(4))+128:PLOT IX,Y1:RETURN
400 FOR I=1 TO 255:SOUND 0,I,.2,15:POK
E 7:0,I:NEXT I
410 L=L-1:IF L<=0 THEN 450
411 SOUND 0,0,0,0
420 COLOR 0:PLOT XX,YY:XX=9:YY=10:RETU
RN
449 REM .....GAME OVER......
450 POSITION 0,19:? #6;"GAME OVER":SC=
0:L=3:SOUND 0,0,0,0
460 IF STRIG(0)=0 THEN 460
470 GOTO 104
499 REM NO MORE OXYGEN
500 L=L-1:POSITION 0,23:? #6;"NO OXYGE
N";'  ':POKE 710,0:FOR I=1 TO 500:NEXT
 I
505 FOR I=1 TO 200:SOUND 0,I,.2,15:NEX
T I
510 COLOR 0:PLOT XX,YY:GOTO 105
999 REM MAIN LOOP
1000 ST=STICK(0)
1010 SOUND 0,100,12,6
1100 IF ST=11 AND YY>1 THEN COLOR 0:PL
OT IX,YY:YY=YY-1:GOSUB 320
1200 IF ST=13 AND YY<19 THEN COLOR 0:P
LOT XX,YY:YY=YY+1:GOSUB 330
1300 IF ST=7 AND XX<19 THEN COLOR 0:PL
OT XX,YY:XX=XX+1:GOSUB 310
1400 IF ST=11 AND XX>0 THEN COLOR 0:PL
OT XX,YY:XX=XX-1:GOSUB 300
1999 REM DISPLAY INFORMATION
2000 POSITION 0,20:? #6;"SCORE=";SC;'
    ';POSITION 9,22:? #6;"LIVES=";L;'
'
2010 POSITION 0,23:? #6;'OXYGEN=';OX;'
 '
2030 SOUND 0,200,12,6
2070 IF OX<=0 THEN GOSUB 500
2080 IF L<=0 THEN 450
3000 IF STRIG(0)<>0 THEN 4000
3005 REM SHOOT....
3100 IF STICK(0)<>14 OR YY<2 THEN 3200
3110 COLOR ASC(CHAR$(12))+128:PLOT XX,
YY-1:PLOT XX,YY-2:GOSUB 3900
3111 FOR I=1 TO 100:SOUND 0,I,6,.5:NEX
T I
3115 FOR I=1 TO 100:NEXT I:COLOR 0:PLO
T XX,YY-1:PLOT XX,YY-2:GOTO 3998
3200 IF STICK(0)=13 OR YY>17 THEN 330
0
3210 COLOR ASC(CHAR$(12))+128:PLOT XX,
YY+1:PLOT XX,YY+2:GOSUB 3900
3211 FOR I=1 TO 100:SOUND 0,I,6,.5:NEX
T I
3215 FOR I=1 TO 100:NEXT I:COLOR 0:PLO
T XX,YY+1:PLOT XX,YY+2:GOTO 3998
```

(listing continued on opposite page)

MINER



ONCE AGAIN YOU have been hired to kill off monsters in the deep caverns of Mars. National Martian Mining Industries has hired you in the hope of killing these monsters once and for all. No one has ever come back from there. Luckily, a new weapon that is able to destroy these monsters has just been invented. One problem remains though — only small amounts of oxygen can be carried at one time so you will have to collect the old oxygen tanks left behind by other adventurers.

You must however, be quick for they disappear after a while. From time to time, a strawberry or cherry will appear. If you decide to collect them you will get bonus points. If you wait too long though, they will go bad and will be no longer edible.

If you are not a very experienced programmer, you might want to skip this section and copy the program. Monster Miner uses two interrupts; the first one, a Vertical Blank Interrupt, moves the player missile objects. If you want more information on that interrupt, refer to articls on the subject in past issues of *Your Computer* or buy one of the numerous books on sale describing this.

The other interrupt plays a background tune while you are playing the game. The operating system of your computer supports five of these general purpose software timers. I used the first one. This timer counts backwards from a non-zero value to zero.

Upon reaching zero, the operating system does an indirect JSR through a RAM vector.

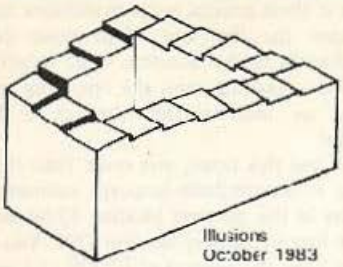
To use this timer, you must Poke the low byte of the machine language subroutine of yours in the memory location $225 and the high byte in memory location $227. You must then Poke the amount of I/60ths of a second you want you computer to wait before it executes your subroutine in location $218. In your subroutine, you must include another Poke with the amount of I/60ths of a second or the subroutine will not execute a second time.

The game also redefines the character set. That is why it takes so long for the program to start.

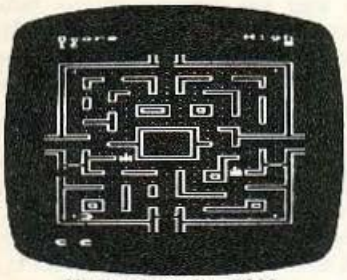
By the way, this program requires at least 24K to run. If you have not got time to copy in the program or you are not very good at typing, you can always send a blank cassette, £3 and a self addressed envelope to the following address: Frederick Shotton, 19 Weidelaan, 1980 Tervuren, Belgium. ■

(listing continued from opposite page)

```
3300 IF STICK(0)<>7 OR XX>17 THEN 3400
3310 COLOR ASC(CHAR$(.0))+128:PLOT XX+
1,YY:COLOR ASC(CHAR$(.1))+128:PLOT XX+
2,YY:GOSUB 3900
3311 FOR I=1 TO 100:SOUND 0,I,6,15:NEX
T I:SOUND 0,0,0,0
3315 FOR I=1 TO 100:NEXT I:COLOR 0:PLO
T XX+1,YY:PLOT XX+2,YY:GOTO 8998
3400 IF STICK(0)<>11 OR XX<2 THEN 4000
3410 COLOR ASC(CHAR$(10))+128:PLOT XX-
2,YY:COLOR ASC(CHAR$(11))+128:PLOT XX-
1,YY:GOSUB 3900
3411 FOR I=1 TO 100:SOUND 0,I,6,15:NEX
T I:SOUND 0,0,0,0
3415 FOR I=1 TO 100:NEXT I:COLOR 0:PLO
T XX-1,YY:PLOT XX-2,YY:GOTO 8998
3900 OX=OX-10
3905 IF PEEK(53252)=4 OR PEEK(53252)=5
 THEN SC=SC+400:POKE 53256,1:FOR I=1 T
O 100:NEXT I:POKE 53256,0:AL0=1:RETURN

3910 IF PEEK(53253)=4 OR PEEK(53253)=5
 THEN SC=SC+400:POKE 53257,1:FOR I=1 T
O 100:NEXT I:POKE 53257,0:AL1=1:RETURN

3920 IF PEEK(53254)=4 OR PEEK(53254)=5
 THEN SC=SC+400:POKE 53258,1:FOR I=1 T
O 100:NEXT I:POKE 53258,0:AL2=1:RETURN

3930 IF PEEK(53255)=4 OR PEEK(53255)=5
 THEN SC=SC+400:POKE 53259,1:FOR I=1 T
O 100:NEXT I:POKE 53259,0:AL3=1:RETURN

3940 RETURN
4000 POKE 53278,0:LOCATE XX,YY,WW
4010 IF WW=ASC(CHAR$(131)) THEN SC=SC+5
00:GOSUB 11000
4020 IF WW=ASC(CHAR$(141)) THEN SC=SC+7
50:GOSUB 11000
4030 IF WW=ASC(CHAR$(51)) THEN SC=SC+1
4040 IF WW=ASC(CHAR$(16)) THEN OX=OX+5
0:SC=SC+100:GOSUB 11000
4045 IF WW=ASC(CHAR$(15)) THEN GOSUB 4
00
4050 FOR I=0 TO 3
4060 IF PEEK(53252+I)=4 OR PEEK(53252+
I)=5 THEN GOSUB 400
4070 NEXT I
4999 IF E=1 THEN OX=OX-2:RETURN
5000 EA=EA+1:IF EA>=243 THEN 107
5010 OX=OX-1:IF OX<=0 THEN 500
6000 IF OX<180 AND OX>150 THEN 6100
6005 IF OX<50 AND OX>30 THEN W=1:GOTO
6100
6010 IF OX<150 AND OX>120 THEN 6200
6020 IF OX<80 OR OX>50 THEN 6300
6050 GOTO 7000
6100 COLOR ASC(CHAR$(16)):IF E=1 THEN
Z=INT(RND(0)*18)+1:C=INT(RND(0)*16)+3:
PLOT Z,C:E=0
6110 IF OX<=51 OR OX<=31 THEN COLOR 0
:PLOT Z,C
6120 GOTO 7000
6200 RR=13:IF RND(0)>0.5 THEN RR=15
6205 COLOR ASC(CHAR$(RR)):IF W=1 THEN
Z1=INT(RND(0)*18)+1:C1=INT(RND(0)*16)+
3:PLOT Z1,C1:W=0
6210 IF OX<=121 THEN COLOR ASC(CHAR$(1
5)):PLOT Z1,C1
6220 GOTO 7000
6300 COLOR ASC(CHAR$(14)):IF W=1 THEN
Z2=INT(RND(0)*18)+1:C2=INT(RND(0)*16)+
3:PLOT Z2,C2:W=0
6310 IF OX<=51 THEN COLOR ASC(CHAR$(15
)):PLOT Z2,C2
6320 GOTO 7000
7000 REM
7001 REM ................
7002 REM MOVE MONSTERS
7003 REM ................
8998 IF AL0=1 AND AL1=1 AND AL2=1 AND
AL3=1 THEN 105
8999 IF AL0=1 THEN X0=0:Y0=0:POKE PLX,
X0:GOTO 9099
9000 IF STICK(0)=14 AND Y0>60 THEN Y0=
Y0-V0:POKE PLY,Y0
9010 IF STICK(0)=13 AND Y0<170 THEN Y0
=Y0+V0:POKE PLY,Y0
9020 IF STICK(0)=7 AND X0<170 THEN X0=
X0-V0:POKE PLX,X0
9030 IF STICK(0)=11 AND X0>60 THEN X0=
X0-V0:POKE PLX,X0
9040 IF STICK(0)<>15 THEN 9099
9050 IF XX>INT(X0/2) AND X0<170 THEN
X0=X0+V0:POKE PLX,X0
9060 IF XX<INT(X0/2) AND X0>60 THEN X
0=X0-V0:POKE PLX,X0
9070 IF YY>INT(Y0/2) AND Y0<170 THEN
Y0=Y0+V0:POKE PLY,Y0
9080 IF YY<INT(Y0/2) AND Y0>60 THEN
Y0=Y0-V0:POKE PLY,Y0
9099 IF AL1=1 THEN X1=0:Y1=0:POKE PLX+
1,X1:GOTO 9199
9100 IF XX>X0 AND X1<170 THEN X1=X1+9:
POKE PLX+1,X1
9110 IF XX<X0 AND X1>60 THEN X1=X1-9:P
OKE PLX+1,X1
9120 IF YY<Y0 AND Y1<170 THEN Y1=Y1+9:
POKE PLY+1,Y1
9130 IF YY>Y0 AND Y1>60 THEN Y1=Y1-9:P
OKE PLY+1,Y1
9199 IF AL2=1 THEN X2=0:Y2=0:POKE PLX+
2,X2:GOTO 9299
9200 IF XX>X0 AND X2>60 THEN X2=X2-V2:
POKE PLX+2,X2
9210 IF XX<X0 AND X2<170 THEN X2=X2+V2
:POKE PLX+2,X2
9220 IF YY<Y0 AND Y2>60 THEN Y2=Y2-V2:
POKE PLY+2,Y2
9230 IF YY>Y0 AND Y2<170 THEN Y2=Y2+V2
:POKE PLY+2,Y2
9299 IF AL3=1 THEN X3=0:Y3=0:POKE PLX+
3,X3:GOTO 1000
9300 IF STICK(0)=14 AND Y3<170 THEN Y3
=Y3+V3:POKE PLY+3,Y3
9310 IF STICK(0)=13 AND Y3>60 THEN Y3=
Y3-V3:POKE PLY+3,Y3
9320 IF STICK(0)=7 AND X3>60 THEN X3=X
3-V3:POKE PLX+3,X3
9330 IF STICK(0)=11 AND X3<170 THEN X3
=X3+V3:POKE PLX+3,X3
9340 IF STICK(0)<>15 THEN 1000
9350 IF XX>INT(X3/20) AND X3>170 THEN
X3=X3+V3:POKE PLX+3,X3
9360 IF XX<INT(X3/20) AND X3>60 THEN X
3=X3-V3:POKE PLX+3,X3
9370 IF YY<INT(Y3/20) AND Y3<170 THEN
Y3=Y3+V3:POKE PLY+3,Y3
9380 IF YY>INT(Y3/20) AND Y3>60 THEN Y
3=Y3-V3:POKE PLY+3,Y3
10000 GOTO 1000
11000 FOR I=200 TO 225:SOUND 0,I,12,15
:NEXT I:SOUND 0,0,0,0:RETURN
19999 REM CHANGE CHSET
20000 DIM CHAR$(17):CHAR$="!(,H&Q^`i.
)Z\X]"
20010 CHSET=(PEEK(106)-8)*256:CHARB=57
344:FOR I=0 TO 511:POKE CHSET+I,PEEK(C
HARB+I):NEXT I
20015 RESTORE 20050
20020 FOR I=1 TO 16:CHPOS=CHSET+ASC(C
HAR$(I)-32)*8:FOR J=0 TO 7:READ A:POK
E CHPOS+J,A:NEXT J:NEXT I
20030 FOR I=32 TO 39:POKE CHSET+I,255-
PEEK(CHARB+I):NEXT I:POKE 756,CHSET/25
6:RETURN
20049 REM DATA FOR SHAPES
20050 DATA 24,24,88,252,88,24,36,36,24
,24,26,63,26,24,36,36,16,56,19,124,124
,19,0,0,0,0,200,62,62,200,28,8
20060 DATA 255,255,255,255,255,255,255,255
,255,16,152,252,116,238,131,0,0,0,152,
141,127,182,127,43,64
20070 DATA 0,10,67,119,289,110,1,0,49,
98,140,242,216,78,51,0,32,80,145,34,18
,10,1,4
20080 DATA 0,8,140,148,83,81,34,0,16,1
2,9,25,102,128,96,16,36,24,126,219,247
,94,52,24
20090 DATA 14,21,100,116,116,110,14,4,
40,50,101,186,111,221,118,44,153,126,1
02,219,219,102,126,153
24999 REM ...PM GRAPHICS SUBROUTINE
25000 RESTORE 26000:FOR I=1536 TO 1706
:READ A:POKE I,A:NEXT I:FOR I=1774 TO
1787:POKE I,0:NEXT I
25010 PM=PEEK(106)-16:PMBASE=256*PM:FO
R I=PMBASE+1023 TO PMBASE+2047:POKE I,
0:NEXT I
25020 FOR I=PMBASE+1025 TO PMBASE+1032
:READ A:POKE I,A:NEXT I
25030 FOR I=PMBASE+1281 TO PMBASE+1288
:READ A:POKE I,A:NEXT I
25040 FOR I=PMBASE+1537 TO PMBASE+1544
:READ A:POKE I,A:NEXT I
25050 FOR I=PMBASE+1793 TO PMBASE+1800
:READ A:POKE I,A:NEXT I
25060 POKE 704,198:POKE 705,20:POKE 70
6,70:POKE 707,228
25070 PLX=53248:PLY=1280:PLL=1734:POKE
559,52:POKE 623,1:POKE 1788,PM+4:POKE
53277,3:POKE 54279,PM
25075 FOR I=0 TO 3:POKE PLL+I,8:NEXT I
25080 X=USR(1536):RETURN
26000 DATA 165,3,139,244,6,240,39,56,2
21,240,6,240,83,141,254,6,106,141
26010 DATA 253,6,142,253,6,24,169,0,10
9,253,6,24,105,252,6,133,204,133
26020 DATA 206,189,240,6,133,203,173,2
54,6,133,205,189,218,6,170,232,46,255
26030 DATA 6,144,15,168,177,203,145,20
5,169,0,145,203,133,202,208,244,76,87
26040 DATA 6,160,0,177,203,145,205,169
,0,145,203,200,202,208,244,174,253,6
26050 DATA 173,254,6,157,240,6,189,236
,6,240,48,133,203,24,138,141,253,6
26060 DATA 106,235,6,133,204,24,173,25
3,6,109,252,6,133,206,189,240,6,133
26070 DATA 205,189,248,6,170,160,0,177
,203,145,205,200,232,208,248,178,253,6
26080 DATA 169,0,157,236,6,202,48,3,76
,2,6,76,98,226,0,0,104,169
26090 DATA 7,162,6,160,0,32,92,228,96
26100 DATA 153,126,90,126,102,189,165,
165,129,126,90,102,126,165,24,102
26110 DATA 255,90,102,60,36,60,66,195,
24,102,36,189,126,24,36,102
30000 RESTORE 30001:FOR I=256 TO 256+1
18:READ A:POKE I,A:NEXT I:RETURN
30001 DATA 104,169,11,141,38,2,169,1,1
41,39,2,174,55,1,139,56,1,141,6,210
30002 DATA 24,105,2,141,4,210,169,164,
141,7,210,141,5,210,238
30003 DATA 55,1,174,55,1,224,63,208,5,
169,0,141,55,1,169,10,141,24,2,96
30004 DATA 0,193,128,144,128,162,128,1
82,128,193,182,162,128,144,162,182,182
,193,128,144,128,152,128,182
30005 DATA 128,193,182,162,128,162,182
,193,193,253,217,253,217,243,193,243,1
93,217,182,217,182,193,217,243,243
30006 DATA 253,217,253,217,243,193,243
,193,217,182,193,243,253,217,253,253
```



Illusions
October 1983



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December issue: Program Features: Killer Dice game, **Galactic Invasion**, a fast moving space invasion game, **LINK**, a very useful disc utility for program development, **ASTAAD**, a really excellent program for **Computer Aided Design**, the **Percussion Machine**, moving **Chequer Board** display, **Screen Freezer**, a routine to freeze your favourite game in mid-play, and a musical rendering of the **Twelve Days of Christmas to add a seasonal flavour. Plus articles on the Teletext Mode** (part 3) and **Fitting an External Speaker**. Plus **Disc Drive Reviews, Book Reviews**, Hints and Tips.

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RESPONSE FRAME

Do you have a problem? Your manual is incomprehensible or you just cannot get the hang of that programming trick you tried — whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame".

SIDEWAYS SCROLL

■ I own a BBC Micro, Model B. I have noticed an effect in many arcade games, on the Beeb and on other machines, that I would like to copy. That is, the sideways scrolling of the screen. I have read routiens in a couple of places that I am totally unable to understand. I do not want a complicated machine-code solution to my problem and wonder if there is some way it could be done in Basic.

Walter Barnard,
London, W12.

ACCORDING TO Ross Symons — author of *Beginner's Guide to Assembly Language on the BBC Micro* — the simplest way of getting a sideways scroll on the BBC is to include the followin in a program:

?850 = 1

You will see now that Control K moves the screen right, and Control J moves it left. You can get the screen to scroll right by Tabbing to the bottom of the screen, and Tabbing at the top to get it to scroll left. That is, if you include

PRINT TAB(0,0);CHR$(11)

in your program, the screen will scroll every time it hits that line. Similarly,

PRINT TAB(0,24)

will cause it to scroll the other way.

GETTING OUT

■ I have a lot of trouble with Insert mode when editing programs on the Vic-20. Is there a way of disabling this mode?

Paul Gordon,
Hoibury,
Southampton.

SIMPLY EXECUTE Poke 216,0 in the direct mode, and Insert mode will be disabled.

WHO'S FAULT

■ I have recently bought a 48K Spectrum and have found that the numbers produced by the In statements used to read the keyboard differ from those in programs in magazines. For example, when no key has been pressed, the number produced is 191 instead of 255. Is this a fault?

C Smith,
Salisbury,
Wiltshire.

NO, THIS IS not a fault. There have been three issues of Spectrums. Issues one and two used different Ins to those on issue three generally.

With most Basic programs this does not cause an insurmountable problem. You need to do two things to modify old Spectrum programs to run on your machine. The first thing is simply to read the instructions for the program, and determine which key press achieves which aim — such as pressing the F key to fire, or whatever. Then, you need to write a short routine which will return to you the In values when various keys are pressed. Next, press the keys you need from the original program — such as F — and substitute the figure you get from your routine for all occurences of the original figure in the listing you are entering. You should find then that you have no further problems.

ALTERNATIVE MID$

■ I have written two data-file type programs for my ZX Spectrum for home use. However, my programs lack a fast and efficient string search routine. Could you sugest a simple routine for the Spectrum to search a long string for a short string as in the BBC's:

```
100 FOR J = 1 TO LEN (LONG$)
    – LEN (SHORT$) + 1
110 IF SHORT$ = MID$(LONG$,J,
    LEN(SHORT$)) THEN 200
120 NEXT J
```

I have tried to adapt this very simple yet fast routine, but cannot find an alternative to Mid$ which the Spectrum does not have.

Kenneth Watson,
Gateshead,
Tyne and Wear

THE ROUTINE you have given for the BBC commits an unpardonable sin, jumping out of an incomplete loop. Run this on the computer for very long, and the BBC Micro would crash with an out of memory error. Although the ZX machines allow you to jump out of loops with impunity, it is extremely bad programming practice, as very few other computers are as tolerant.

Putting that aside, it is unfortuante that the Instr$ command, which searches through one string for the occurence of another, and returns a number which is the starting position of the second string — or zero if it is not found — is not available on the Spectrum. This would solve your problem very quickly.

All the standard string-handling commands — Left$, Mid$, Right$ — can be emulated in ZX Basic. The following program, although not brilliantly efficient, should do the job for you.

```
10 A = LEN(LONG$):B = LEN
   (SHORT$)
20 J = 1
30 IF LONG$(J TO B – 1) = SHORT$
   THEN 60
40 IF J<A THEN J = J + 1:GOTO 30
50 PRINT "NOT FOUND":GOTO 70
60 PRINT "STRING FOUND,
   STARTING AT ELEMENT";J
```

Note how lines 20 and 40 do not create a loop which will be prematurely exited.

LETTER PRINT

■ I have a Vic-20 computer and I have made a program to write a letter. Could you please tell me how I could print that letter out on a printer? The address is in Print statements and the letter is written as inputs ie., A$, B$, etc.

A R Lilly,
Bishop Auckland,
County Durham.

IT IS UNFORTUNATE that the Commodore computers do not allow the simple access to printer afforded by many other machines. To dump a screen, for example, is a quite torturous process, and even listing a program requires three steps.

To solve your particular problem, you need to include #4, After the word Print and before the material you want to Print as follows:

PRINT # 4, "YOUR ADDRESS" or
PRINT # 4, A$

To turn the printer on, enter Open 4,4 then press Return, followed by CMD4 and again press Return. Then run your program, making sure you include a Close 4 at the very end.

MICRODRIVE COPY

■ Could you answer a question that I am sure is uppermost in the minds of all Spectrum owners interested in the Microdrive. Is it possible to copy one's own cassette-based commercial software onto the Microdrive to enable faster loading?

Ken Watson,
Gateshead,
Tyne and Wear.

COPYING ONTO the Microdrives presents the same obstacles as copying a commercial "save-blocked" cassette onto cassette. If you can save a program onto cassette, you can save it onto Microdrive. If the program has been saved so that it cannot be resaved onto another cassette, without the use of the one of the "lock breaker" programs, then you will not be able to save it onto Microdrive.

ACOUSTIC MODEMS

■ I am interested in purchasing a computer for 'over-the-telephone' line networking. At the moment, I own a Spectrum, but am interested in the Vic-20 or the Commodore 64. Could you please tell me if there is a Modem available for either of these — preferably an acoustic Modem? I have seen one Modem which plugs directly into the telephone socket. Does this mean that the computer can be programmed to dial a telephone number?

Ian Curnock,
Inkberrow,
Worcestershire.

FIRST, LET ME say that as far as I have been able to ascertain, it is illegal to plug Modems directly into the telephone lines in the UK, which is why so many acoustic Modems are available for various machines. It is quite feasiable for a computer — using an acoustic Modem — to dial a number for you, so a plug-in Modem would, of course, be able to do the same thing.

Acoustic Modems have been produced for both the machines you ask about, although it may not be too easy to get hold of them. I have looked through the latest issues of *Commodore Horizons* and *Commodore User* and did not see a single advertisement for Modems for either machines.

However, before you rush out and buy the computer of your choice, you had better determine who or what it is you will be communicating, via the telephone and computer, with. Are you intending to talk to friends, access Prestel or whatever? It would make sense to make your decision of which microcomputer to buy for this purpose on the machines which your associates — if it is them you wish to talk with — already have.

JUPITER DAWN

■ Now that Jupiter Cantab have gone out of business, does that mean that I, and thousands of other Jupiter Ace owners, are going to be left out in the cold? I had not had my Ace long when I heard about the company folding. I think this is most unfortunate as I was just at the point of expanding my machine. Is there anyone still out there who is supporting this great little computer?

Neville Wright,
London E17.

THERE HAS BEEN no indication from manufacturers supporting the Jupiter Ace that they will withdraw that support, simply because the computer is no longer available. The Pace 16K RAM unit is one of several expansion units available for the Ace, and sells for £20. It can be further expanded, for £14.50, to bring the Ace's full memory to 32K.

COMPUTER CAMP

In a recent issue of Your Computer I mentioned a few computer camps in response to a query from Malcolm Parks of Amersham. Following the publication of that letter, I heard from Cyril Tyson, director of Camp Aldenham, which is a "non-residential adventure and computer camp for boys and girls from five to 13 years", near Letchmore Heath, about 20 miles from central London.

The computer camp is designed for children between nine and 13 years old and consists of one session of two hours each day. If you want to know more, write to the camp for a brochure at Camp Aldenham, Aldenham School, Elstree, Herts, WD6 3AJ.

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MATRIX

Jeff Minter has taken Gridrunner – the game that topped Beatsellin' charts in USA and UK – and created an awesome sequel.
Graphically superb, it features multiple screens, new aliens and attack waves, mystery bonuses, renegade humanoids, deflexor fields, diagonal tracking countdown/panic phase and much, much more... Packed into 20 mind-zapping zones and accompanied by incredible sonics.
8K expansion required.
Available for Commodore 64 £7.50
and VIC-20 £6.

HOVER BOVVER

A totally original arcade game for C64 featuring outstanding graphics and a sound track created by a professional Piano Wizard. Gordon Bennet has borrowed his neighbour's Air Mo' lawnmower. Mow your way through as many of the 16 lawns as you can before the pursuing neighbour retrieves his mower. Set your dog onto the neighbour to help you out of tight spots and don't annoy the gardener. Try not to plough through the neat flower beds or overheat your mower.
£7.50

ATTACK of the MUTANT CAMELS

Planet earth needs you! Hostile aliens have used genetic engineering to mutate camels from normally harmless beasts into 90 foot high, neutronium shielded, laser-spitting death camels!! Can you fly your tiny, manoeuvrable fighter over the mountainous landscape to weaken and destroy the camels before they invade the humans stronghold! You must withstand withering laser fire and alien UFOs. Game action stretches over 10 screen lengths and features superb scrolling scanner 1/2 player actions and unbelievable animation! Play this game and you'll never be able to visit a zoo again without getting an itchy trigger finger! Awesome m/c action!
Available for
Commodore 64 £7.50.

REVENGE OF THE MUTANT CAMELS

At last the long awaited sequel to Attack of the Mutant Camels is available. You are controlling a ninety foot high, neutronium shielded, lazer spitting death camel; leading a rebellion against your evil Zzyxian overlords. The game features beautiful smooth scrolling graphics and no less than 42 different attack waves, more than any game in video history. The challenge of play will last for months as you battle to see what's on the next wave.

GRIDRUNNER

Finally true arcade quality on the unexpanded VIC!
Shoot down the segmented DROIDS invading the grid.
Beware of the pods and zappers!
This awesome speed, sound and graphics gives you the best blast available for unexpanded VIC.
Available for VIC-20 £5.00
Commodore 64 £5.00
Atari 400/800 £7.50

All orders add 50p postage and packing

llamasoft

AWESOME GAMES SOFTWARE

49 MOUNT PLEASANT,
TADLEY, HANTS. RG26 6BN.
TELEPHONE: TADLEY (07356) 4478

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SOFTWARE FILE

Software File gives you the opportunity to have your programs, ideas and discoveries published. We will accept contributions for any home computer provided they are submitted to *Your Computer* exclusively. Please double-check your programs and specify the memory they require before sending them, preferably on cassette. We pay between £6 and £36 for contributions published.

Jump Bug

Umer Nalla,
Bolton.

SPECTRUM

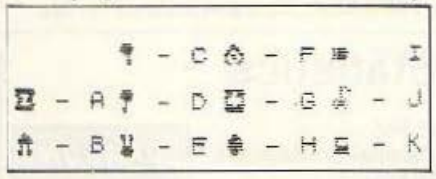
CALLED JUMP BUG and for a 16K or 48K ZX Spectrum, this game involves getting a bug to the top of the screen, by jumping through gaps in the platforms. On the first sheet it is fairly easy but on following sheets, hazards are introduced, such as a cannon-ball, a missile and a heat-seeking mutant alien. The platforms also get to move faster as the skill increases. When you lose a life, you will be informed of the cause.

Type in program 1 and check it twice. Then Run it and Save it to tape. Type New to clear the computer, *not* USR 0, as this will clear the machine code as well. Now type in program 2. Save this by typing

GOTO 999

and Verify it. Now Run it. If the program crashes, reload both programs and check the first for mistakes in data and correct mistakes. If none exists then check all the Poke and USR address in program 2. Correct any mistakes.

The program should now run successfully.



Program 1.

```
  10 BORDER 2: PAPER 0: INK 0
  20 CLEAR 32243
  40 PRINT AT 11,6: INK 7: FLASH
 1; BRIGHT 1;"P.ease wait a mome
nt"
  50 FOR a=32244 TO 32494
  60 READ b: POKE a,b: NEXT a
  70 DATA 14,8,229,17,31,0,25,12
8,237,82,31,8,32,126,31,119,35,1
8,250,225,35,13,32,234,201
  80 DATA 14,8,175,229,17,31,0,2
7,32,126,23,23,5,32,126,23,119,
13,18,250,225,36,13,32,233,201
  90 DATA 33,95,64,205,13,126,33
,128,64,205,244,125,33,128,64,20
7,244,125,33,128,64,205,13,126,0
3,0,72,205,244,125,33,0,72,205,2
44,125,33,0,72,205,244,125
  100 DATA 95,121,92,0,0,0,0,0,0,
0,230,2,40,20,33,64,72,205,244,1
25,33,64,72,205,244,125,33,64,72
,205,244,125,24,18,33,95,72,205,
13,126,33,95,72,205,13,126
  110 DATA 33,128,72,205,244,125,
33,192,72,205,244,125,33,192,72,
205,244,125,33,31,80,205,13,126,
33,31,80,205,13,126,33,95,80,205
,13,126,201
  120 DATA 33,128,72,205,244,125,
33,192,72,205,244,125,33,31,80,2
05,13,126,33,95,80,205,13,126,20
1
  130 DATA 33,95,64,205,13,126,33
,128,64,205,244,125,33,0,72,205,
244,125,201
  140 DATA 00,80,64,205,13,126,00
,223,64,205,13,126,33,128,72,205
,244,125,33,192,72,205,244,125,2
01
  150 PRINT AT 11,6; INK 0; PAPER
 7; FLASH 1; BRIGHT 1;"  L[illegible]I
[illegible] [illegible]"; INVERSE 1; FLASH 1;"
[illegible]"
  160 PRINT AT 0,0: LOAD ""
  999 SAVE "Jump bug" LINE 1
```

Program 2.

```
   1 REM     PROGRAM 2
   2 REM by U.Nalla
   4 LET ms=2: LET lives=4: LET
sc=0: LET sk=-1: BORDER 6: PAPER
6: INK 1: CLS : POKE 32425,201:
POKE 32450,201: POKE 32469,201:
GO TO 5010
   5 LET bx=3: LET by=15: LET mx
=3: LET my=1: LET s=1: LET ax=3:
LET ay=15: LET x=19: LET y=16:
LET m$="A": LET s$="*"
  10 PRINT AT 0,23;"MEN ";lives;
PRINT : FOR k=1 TO 18 STEP 2: P
RINT BRIGHT 1; INK 0; PAPER 7;"[illegible]"
[illegible]
  PRINT : NEXT k
  15 FOR k=2 TO 18 STEP 2: FOR j
=1 TO INT (RND*sk)+1: PRINT AT k
,INT (RND*26)+2; BRIGHT 1; PAPER
7;"  ": NEXT j: NEXT k
  16 PRINT AT 8,0; BRIGHT 1; PAP
ER 0; INK 7;"[illegible]"
  18 PRINT AT 20,0; PAPER 5; INK
3; BRIGHT 1; FLASH 1;"[illegible]"
  25 PRINT AT 1,1; INVERSE 1; PA
PER 7;"[illegible]": FLASH 1;
INK 6; PAPER 1;"##": FLASH 0; P
APER 7; INK 1;"[illegible]"
  40 FOR k=0 TO (INT (RND*30)+4)*
2 STEP 2: PRINT AT k,INT (RND*30
)+1; INK 1; PAPER 5; FLASH 1;"[illegible]"
: NEXT k
  90 FOR v=1 TO 5 STEP 0
 100 BEEP .001,16: LET lx=x: LET
ly=y: PRINT AT x,y; INK 5; PAPE
R 6;m$
 105 IF INKEY$<>"p" AND INKEY$<>
"o" AND INKEY$<>"q" THEN LET a$=
"": GO TO 130
 107 LET a$=INKEY$
 110 IF a$="q" THEN IF SCREEN$ (
x-1,y)=" " THEN LET x=x-2: LET a
$=m$: LET m$="A": LET a$="": FOR
k=1 TO 8: BEEP .05,k*5: RESTORE
USR 32295: NEXT k: LET sc=sc+20
: GO TO 130
 115 IF a$="y" THEN IF SCREEN$ (
x-1,y)=" " THEN GO SUB 8050: GO T
O 8010
 120 IF a$="p" THEN LET m$="[illegible]"
 125 IF a$="o" THEN LET m$="[illegible]"
 130 IF SCREEN$ (x,y)="E" THEN G
O TO 5000
 132 LET y=y+(m$="[illegible]")-(m$="[illegible]")
 135 IF y=ly THEN LET m$=o$
 140 IF y>30 THEN LET y=30
 145 IF y<1 THEN LET y=30
 150 FOR k=0 TO sk-1: RESTORE US
R 32295: NEXT k
 160 IF SCREEN$ (x-1,y)=" " THEN
GO SUB 8050: GO TO 8200
 162 IF a$="*" THEN LET a$="p"
 165 IF x=1 THEN IF SCREEN$ (x,y
)="" THEN GO SUB 8050: GO TO 801
0
 167 IF ATTR (x,y)=169 THEN BEEP
.5,30: BEEP .05,20: LET sc=sc+1
00
 170 PRINT AT lx,ly;" ";AT x,y;
INK 3; PAPER 6;m$;AT 0,2; INVERS
E 1;"SCORE ";sc;
 175 IF sk<1 THEN NEXT v
 180 LET ox=ax: LET oy=ay: PRINT
AT ax,ay; INK 2; PAPER 6;"[illegible]"
 190 IF SCREEN$ (ax+1,ay)=" " TH
EN LET ax=ax+2: BEEP .02,50
 195 LET ay=ay+s: IF ay>29 OR ay
<2 THEN LET s=s*-1: IF ax=19 THE
N LET ax=3
 200 PRINT AT ox,oy;" ";AT ax,ay
; INK 2; PAPER 6;"[illegible]"
 205 IF ax=x THEN IF ay=y OR ay+
1=y OR ay-1=y THEN GO SUB 8050:
GO TO 8020
 208 IF sk<2 THEN NEXT v
 210 LET x0=ax: LET y0=ay: PRINT
AT ax,ay; INK 4;"[illegible]": IF ay+ms>2
7 THEN LET mx=mx+2: LET my=1: IF
mx>19 THEN LET mx=3
 220 IF mx=x THEN IF my<=y THEN
IF my+ms>=y THEN GO SUB 8050: GO
TO 8020
 230 LET my=my+ms: PRINT AT x0,y
0;" ";AT mx,my;"[illegible]": BEEP .0008,2
0: BEEP .0008,15
 240 IF sk<3 THEN NEXT v
 250 LET cx=bx: LET cy=by: PRINT
AT bx,by;"[illegible]": LET a=INT (RND*10
)+1: LET bx=bx+s: LET by=by+(y>b
y AND a(4)-(y<by AND a>6): IF bx
>19 THEN LET bx=3
 260 PRINT AT cx,cy;" ";AT bx,by
;"[illegible]": BEEP .0008,35
 265 IF bx=x AND by=y THEN GO SU
B 8050: GO TO 8020
 270 NEXT v
 280 GO TO 99
5000 LET sc=sc+200: FOR k=1 TO 1
00: NEXT k: BORDER 7: PAPER 7: I
NK 3: CLS : BEEP .1,10: BEEP .1,
20: BEEP .5,15: PRINT AT 2,10; F
LASH 1; BRIGHT 1;"WELL DONE!": P
AUSE 50: PRINT PAPER 7; INK 3;"T
AB 6;"BUT": BEEP .5,6: PRINT "
NOW ";: BEEP .5,4: PRINT "IT ";:
BEEP .5,3: PRINT "GET'S ": BEEP
.5,2: PRINT AT 6,11; BRIGHT 1;"
HARDER ": BEEP .5,1: BEEP .5,10
5010 PAUSE 50: LET sk=sk+1: IF s
k>3 THEN LET sk=3
5015 PRINT AT 9,5; BRIGHT 1; INK
3; PAPER 7;"HOW HIGH CAN YOU TR
Y?";AT 0,7; INK 0; PAPER 6; FLAS
H 1;" U U M P S U G "
5020 FOR q=0 TO sk: BEEP .5,q: P
RINT AT 18-(q*2),15; INK q;CHR$
(150+q);"  ";(q-1)*50;" M": NE
XT q
5030 PAUSE 30
5060 IF sk=1 THEN POKE 32425,0
5065 IF sk=2 THEN POKE 32450,0
5070 IF sk=3 THEN POKE 32469,0
5075 IF sk>=2 THEN LET ms=ms+1:
IF ms>5 THEN LET ms=5
5080 IF sk>3 THEN LET sk=3
5090 PAUSE 50: FOR k=0 TO 10: BE
EP .005,55: PRINT AT 21,k;" ": F
LASH 1; BRIGHT 1; PAPER 7; INK 0
;"S to start": NEXT k
5100 BEEP .05,40: BEEP .05,50: B
EEP .05,30: BEEP .05,59: IF INKE
Y$<>"s" THEN GO TO 5100
5110 BORDER 6: PAPER 6: INK 1: C
LS : GO TO 5
6000 LET lives=lives-1: IF lives
<1 THEN GO TO 6100
6010 PAUSE 50: PRINT AT 21,2;"Pr
ess any key to continue": PAUSE
0: CLS : GO TO 5
6100 INPUT "Press ENTER to play
"; LINE a$: RUN
7999 STOP
8000 PAUSE 10: PRINT AT lx,ly;"
";AT 19,y; FLASH 1; BRIGHT 1;"
fell through
 a hole ": GO TO 6000
8010 PRINT AT lx,ly;" ";AT 19,y;
 FLASH 1; BRIGHT 1;"[illegible]"; BRIGHT 0
;AT 21,2;"banged your head": GO
TO 6000
8020 PRINT AT 21,2; FLASH 1; BRI
GHT 1;"Shot!!": GO TO 6000
8030 PRINT AT 21,2; FLASH 1; BRI
GHT 1;"Gobbled!": GO TO 6000
8040 PRINT AT 21,2; FLASH 1; BRI
GHT 1;"Mutated!!": GO TO 6000
8050 FOR k=1 TO 100: NEXT k: FOR
 k=89 TO 10 STEP -2: BEEP .001,k
: NEXT k: FOR k=1 TO 2: FOR j=x
TO 19 STEP 2: PRINT AT j,y;"[illegible]";A
T j-2,y;" ": BEEP .01,j*3: NEXT
j: NEXT k
8060 FOR k=4 TO 1 STEP -1: PRINT
 AT 19,y; BRIGHT 1; FLASH 1;CHR$
 (144+k): PAUSE 10: BEEP .5,k: N
EXT k
8070 RETURN
9000 STOP
9990 RESTORE 9991: FOR k=USR "a"
 TO USR "*"+7: READ a: POKE k,a:
 NEXT k
9991 DATA 255,255,195,102,102,19
5,255,255,24,60,126,126,36,36,10
2,102,60,120,126,60,6,6,12,12,60
,126,126,60,16,16,48,48
9992 DATA 102,102,36,36,60,126,1
26,60,24,60,102,195,153,153,195,
102,255,231,231,129,129,231,255,
255
9993 DATA 24,60,122,126,126,122,
60,24,0,0,185,190,255,190,186,0,
20,19,16,16,54,185,186,66
9994 DATA 0,0,126,66,66,126,126,
255
9997 RETURN
9998 SAVE "JUMP" LINE 9999: STOP
9999 GO SUB 9990: RUN
```

Buzz

Tony Davies,
West Briogford,
Nottinghamshire.

DRAGON

THIS IS A FAMILY game, notable for its cartoon-quality graphics, which show to advantage the ease with which the Draw and Paint commands of the Dragon can be used to produce such effects. It also has fast-moving

(continued on next page)

```
5 CLEAR5000:CLS
6 PRINT@200,"COPYRIGHT":PRINT@264,"R.A.DAVIS':PRINT@32
8,"1983"
10 PMODE3,1:PCLS
11 M1$="L402AL8GGL4F+GG+AG+A"
12 M2$="BL8AAL4G+ABO+CO-BO+C"
13 M3$="O3DCO-BO+CO-BAG+A"
14 M4$="GBA+BAGF+G"
15 M5$="O3L2DL4O-GGO+L2DL4CL2C"
16 M6$="T4;XM1$;XM2$;XM3$;XM4$;XM1$;XM2$;XM3$;XM5$;"
17 GOSUB2000
```

(listing continued on next page)

(continued from previous page)

action and a continuous display of scoring, with a high-score feature.

The screen displays a lily-pond with a frog sitting on one of the lily-pads. By using the right-hand joystick and its fire button, you can aim the frog's tongue to hit the buzzing fly and so score points. If, however, you hit the wasp instead, your score will revert to zero.

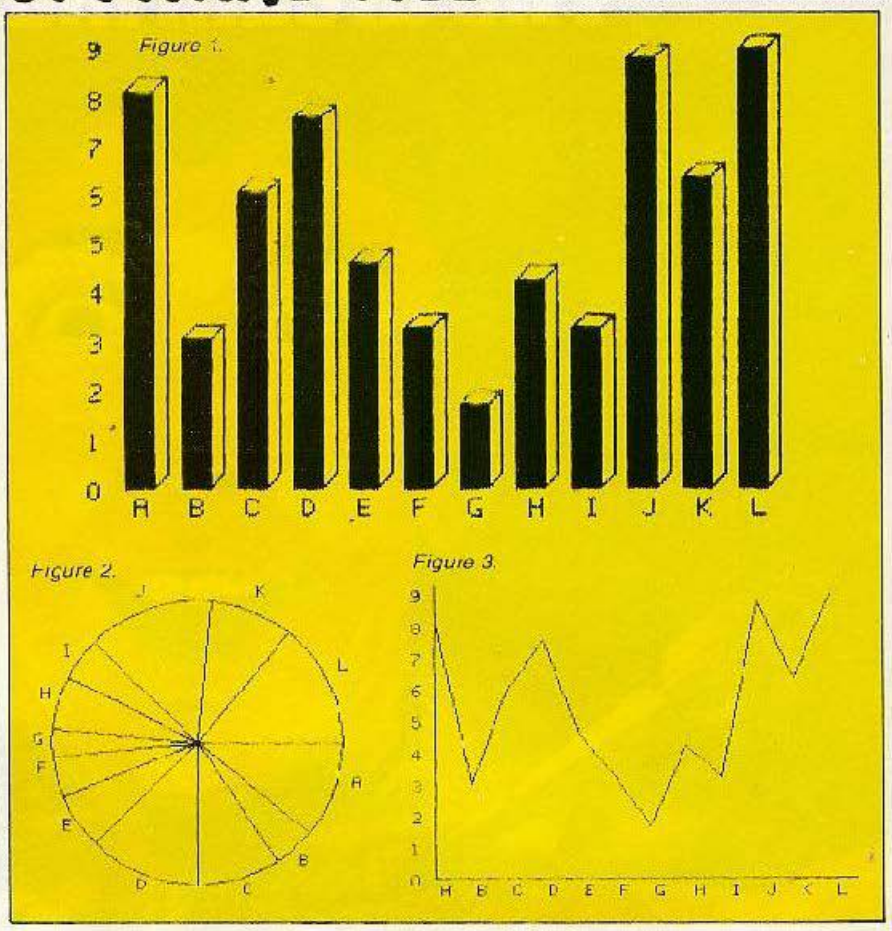
There are nine levels of difficulty and a choice of game length from one to three minutes. The listing also gives a signature tune — The Blue-Tail Fly — and an introductory display, which give the final product some polish.

Line	Function
11-16	Make the tune.
19	Introduction.
20-310	The background.
320-440	The frog.
450-560	The scoring.
561-568	The options.
600-637	The wasp and fly (O$ and A$)
675-740	The action and check for hit routine.
2000-2195	The titling.

(listing continued from previous page)

```
10 PMODE3,1:PCLS1
11 CLS0:SOUND80,1                    :PRINT930,"HELP THE FROG";:P
RINT934,"TO HIT THE FLY";:PRINT@196,"USE RIGHAND JOYST
ICK";:PRINT@260,"AND FIRE BUTTON BUT";:PRINT@324,"DON
T HIT THE WASP";:PRINT@388,"OR YOU LOSE IT ALL ";
29 LINE(0,120)-(256,120),PRESET
30 PAINT(1,1),2,4
40 PAINT(1,122),3,4
50 CIRCLE(50,140),50,1,,.25
60 CIRCLE(190,150),50,1,.25
70 PAINT(50,140),1,1:PAINT(190,150),1,
80 DRAW"BM50,140;C5F12L12U12"
90 PAINT(55,142),3,3
100 DRAW"BF190,150;C3NR6F20"
110 PAINT(210,195),3,3
120 CIRCLE(190,,250),4,1
130 CIRCLE(190,,250),3 ,2,1
140 CIRCLE(190,,27),10,2
150 CIRCLE(190,,30),15,2
160 CIRCLE(190,,28),12,2
170 GOSUB20,1:,10,3
180 PAINT(20,1),3,3
190 CIRCLE(40,3 ,20,3
200 PAINT(40,3),3,3
210 CIRCLE(60,3 ,25,3
220 PAINT(65,3),3,3
230 CIRCLE(90,3 ,15,5
240 PAINT(90,3),3,3
250 CIRCLE(105,3 ,10,3
260 PAINT(100,3 ,3,3
270 FOR X=0 TO 50 STEP 5:FOR Y=RND(80) TO 120
280 LINE(X,Y)-(X,Y),PRESET:NEXT:NEXT
290 FOR X=250 TO 250 STEP4:FOR Y=RND(80)TO 120
300 LINE(X,Y)-(X,Y),PRESET
310 NEXT:NEXT
320 DRAW"BM100,100;C4U2L4U4L4U4L8U3H3,2D2L1L2L3D1L1G2L2BL
6L2BL6L3D,D2L2BL3D2L3D2D2D2BF2R10NR10D2L3BL1D1F2FD
FFFR2BF2R2F2U4R4E2L8L3E3L3U2R3ER3ER3ER3EU3U2U4R
2L2BL3BL4F"
330 DRAW"BM100,100;C4D2D3L3D2D3D2BL3DL6DL6L3BF15R5D5
R10D3BL3UR4BL8R4E5"
340 LINE(33,120)-(77,120),PRESET
350 PAINT(40,100),1,4
360 PAINT(77,120),1,4
370 PAINT(50,125),1,4
380 PAINT(60,125),1,4
390 PAINT(50,142),1,4
400 DRAW"BM100,100;C4L10NU4L8D2D3BF2E2L3DL6L3D2L3D
L2L3D2D2D2
```

```
210 CLS
220 REM SCALING FACTOR
230 E=B(1)
240 FOR R= 1 TO T-1
250 IF B(R+1)>E THEN E= B(R+1)
260 NEXT R
270 F=INT(175/E)
280 REM PRODUCTION OF TOTAL
290 FOR R = 1 TO T
300 B(R)=B(R)/E
310 IF B(R)<.01 THEN PRINTC$(R):IF B(R)=0 THEN PRINT"W
ILL NOT SHOW ON THE PIE CHART DUE TO A ZERO ENTRY":EL
SE PRINT"MAY NOT SHOW ON THE PIE CHART  DUE TO A LARG
E VARIENCE"
320 NEXT R
330 FOR R= 1 TO 3000:NEXT R:CLS
340 REM NUMBERS AND LETTERS
350 A$(0)="BR1R2L1U4R1L2D4U4L2D1"
360 A$(1)="BR1R2L1U6R1L1D5R1L"
370 A$(2)="BL4U1E2R1E1U1H1L2E1BU1"
380 A$(3)="BU1F1R2E1D1H1L1R1E1D1H1L2D1BU1"
390 A$(4)="BR3U6G3D1R4U4BL4"
400 A$(5)="BU1E1R2F1D2H1L2U2R1L4"
410 A$(6)="BR1R2E1D1H1L2D2U3E2R2L2BL2"
420 A$(7)="BR1U2R3U1L4"
430 A$(8)="BR1R2E1U1H1L2G1D1U3E1R2E1U1H1L2D1D1L1BU1"
440 A$(9)="BR2E2U3H1L2G1D3F1R2U3H1L2BL1"
450 B$(1)="U3R4D3U5H1L2BD5U3BU1"
460 B$(2)="R3E1U.H1L2R3E1U1H1L3BL6"
470 B$(3)="BR1R2E1G1H1L2E1R2F1H1L2BL1"
480 B$(4)="R2E2U2H2L2D4U6"
490 B$(5)="BL4U3R3L3U3R4.4"
500 B$(6)="U3R3L3U3R4L4"
510 B$(7)="BR1R3U2L1R1D2L3H1U4E1R2L3BR1"
520 B$(8)="U3R4D3U6D3L4U3"
530 B$(9)="BR1R2L1U6R1L2BL1"
540 B$(10)="BU1F1R2E1U3BL4"
550 B$(11)="U3R1F3H2E3G3L1U3"
560 B$(12)="BL4U6"
570 PRINT @ 192,"DO YOU WANT A PRINTOUT Y/N"
580 INPUT A$
590 CLS
600 IF A$="Y" OR A$="N" THEN 610 ELSE 570
610 IF A$="N" THEN 660
620 C=40-(LEN(T$)/2)
630 PRINT#-2,CHR$(15);TAB(C);T$
640 FOR I= 1 TO LEN(T$)
650 PRINT#-2,TAB(C);"-";
660 NEXT R
670 PRINT#-2
680 PRINT@192,"TO REVERT TO TITLE PAGE ENTER 2"
690 FOR R= 1 TO 3000:NEXT R
700 C=16-(LEN(T$)/2)
710 REM TITLE PAGE
720 CLS
730 PRINT@C,T$
740 PRINT@ 137,"WHICH PROGRAM ?"
750 PRINT
760 PRINT"(1) PIE CHART"
770 PRINT"(2) MEAN, VARIENCE, STANDARD          DEVIATIO
N
780 PRINT"(3) PERCENTAGE CHART"
790 PRINT"(4) BAR GRAPH"
800 PRINT"(5) FREQUENCY POLYGON"
810 PRINT"(6) HISTOGRAM"
820 PRINT"(7) STOP"
830 INPUT P
840 ON P GO TO 850,1090,1260,1400,1580,1670,2080
850 REM PIE CHART
860 CMPBE4,1:SCREEN1,0:CLS
870 SP=0
880 Q=0
890 FOR R= 1 TO T
900 Q=SP
910 SP= SP+B(R)
920 CIRCLE(128,96),91,0,,,Q+B(R)/2
930 X=PEEK(&HBD)+256*PEEK(&HBE)
940 Y=PEEK(&HBF)+256*PEEK(&HC0)
950 LINE(128,96)-(X,Y),PRESET
960 DRAW$(R)
970 NEXT R
980 SP=0
990 FOR R= 1 TO T
1000 SP=SP+B(R)
1010 CIRCLE(128,96),92,1,1,0,SP
1020 X=PEEK(&HBD)+256*PEEK(&HBE)
1030 Y=PEEK(&HBF)+256*PEEK(&HC0)
1040 LINE(128,96)-(X,Y),PSET
1050 CIRCLE(128,96),92,1
1060 NEXT R
1070 IF A$="Y" THEN GO SUB 1760
1080 IF INKEY$="Z" THEN 720 ELSE 1080
1090 REM MEAN, VARIENCE, STANDARD DEVIATION
1100 B=0:M=B/T
1110 FOR R= 1 TO T
1120 A=(B(R)-M)^2
1130 B=B+A
1140 NEXT R
1150 V=B/T:D=SQR(V)
1160 PRINT"MEAN = ";INT M*100)/100
1170 PRINT
1180 PRINT"STANDARD DEVIATION = ";INT(D*100)/100
1190 PRINT
1200 PRINT"VARIENCE = ";INT(V*100)/100
1210 IF A$="N" THEN GO TO 1250
1220 PRINT#-2,CHR$(15);"MEAN = ";INT M*100)/100
1230 PRINT#-2,"VARIENCE = ";INT(V*100)/100
1240 PRINT#-2,"STANDARD DEVIATION = ";INT(D*100)/100
1250 IF INKEY$="Z" THEN 720 ELSE 1250
1260 REM PERCENTAGE CHART
1270 PRINT"CODE NAME";TAB(20);"AMOUNT";TAB(29);"%"
1280 FOR R= 1 TO T
1290 PRINT;CHR$(64+R);"=";C$(R);
1300 PRINT@B(20);:PRINTUSING"###";A$(R);
1310 PRINT@(25);:PRINTUSING"###.##";B(R)*100;
1320 NEXT R
1330 IF A$="Y" THEN PRINT#-2,CHR$(15);"CODE NAME";TAB(2
0);"AMOUNT";TAB(29);"PERCENTAGE":ELSE GO TO 1360
1340 PRINT#-2
1350 FOR R= 1 TO T
1360 PRINT#-2,CHR$(64+R);"=";C$(R);
1370 PRINT#-2,CHR$(16);CHR$(20);:PRINT#-2,USING"###";A
(R);:PRINT#-2,CHR$(16);CHR$(21);:PRINT#-2,USING"###.##
";B(R)*100
1380 NEXT R
1390 IF INKEY$="Z" THEN 720 ELSE 1390
1400 REM BAR CHART
1410 PMODE4,1:SCREEN1,0:CLS
1420 FOR R= 20 TO 20+T STEP 20
1430 LINE(R,180)-(R,180-F*B(R/20)),PSET
1440 DRAW"BR10"
1450 LINE-(R+10,180-F*B(R/20)),PSET
1460 LINE-(R+15,175-F*A(R/20)),PSET
1470 DRAW"BL10R10"
1480 LINE-(R+10,180),PSET
1490 DRAW"NL10E5"
1500 PAINT(R+1,179)
1510 NEXT R
1520 GO SUB 1760
1530 GO SUB 2020
1540 IF A$="Y" THEN GO SUB 1860
1550 IF INKEY$="Z" THEN 720 ELSE 1550
1560 REM FREQUENCY POLYGON
1570 PMODE4,1:SCREEN1,0:CLS
1580 FOR R=20 TO 120+ T-1)STEP 20
1590 LINE(R,180-F*A(R/20))-(R+10,180-F*B(R/20+1)),PSET
1600 NEXT R
1610 LINE(20,180)-(20,0),PSET
1620 LINE-(120,180)-(256,180),PSET
1630 GO SUB 1760
1640 GO SUB 2020
1650 IF A$="Y" THEN GO SUB 1860
1660 IF INKEY$="Z" THEN 720 ELSE 1660
1670 REM HISTOGRAM
1680 PMODE4,1:SCREEN1,0:CLS
1690 LINE(20,180)-(20,0),PSET
1700 LINE(20,180)-(256,180),PSET
1710 FOR R=20 TO (T*20) STEP 20
1720 IF A(R/20)=0 THEN 1770
1730 LINE(R,180)-(R,180-F*A(R/20)),PSET
1740 DRAW"R20"
1750 LINE-(R+20,180),PSET
1760 PAINT(R+1,179)
1770 NEXT R
1780 FOR R= 40 TO (T*20) STEP 20
1790 LINE(R,180)-(R,180-F*A(R/20)),PRESET
1800 NEXT R
1810 GO SUB 1760
1820 GO SUB 2020
1830 IF A$="Y" THEN GO SUB 1860
1840 IF INKEY$="Z" THEN 720 ELSE 1840
1850 REM DATA PRINTOUT
1860 PRINT#-2,CHR$(12)
1870 FOR Y= 0 TO 191 STEP 7
1880 FOR X= 0 TO 255
1890 A=PPOINT(X,Y)+PPOINT(X,Y+1)*2+PPOINT(X,Y+2)*4+PPO
INT(X,Y+3)*8+PPOINT(X,Y+4)*16+PPOINT(X,Y+5)*32+PPOINT(
X,Y+6)*64+128
1900 PRINT#-2,CHR$(A);
1910 NEXT X
1920 PRINT#-2,CHR$(13);
1930 NEXT Y
1940 PRINT#-2,CHR$(15)
1950 RETURN
1960 REM DRAW LETTERS
1970 DRAW"BR25,190"
1980 FOR R= 1 TO T
1990 DRAW$(R)+"BR2U6D6"
2000 NEXT R
2010 RETURN
2020 REM DRAW NUMBERS
2030 DRAW"BR6,164"
2040 FOR R= 0 TO 9
2050 DRAW$(R)+"BR12"
2060 NEXT R
2070 RETURN
2080 REM END OF PROGRAM
2090 STOP
```



Trade

Llys Gwyn,
Boncath,
Dyfed.

ZX-81

TRADE IS A GAME for one to four players. The object of the game is to buy and sell goods and to make a profit. After the chosen number of turns has been completed, the player with the most money is the winner.

When the program is run the screen will be blank for a few seconds. When selecting the number of turns 10 is the minimum for a good game. When contracts is displayed it means that the port shown wishes to import the units of goods displayed.

When in port you may buy or sell goods or list information. Your ship has three holds each of which can take up to 500 units of any one type of goods. On selling each hold is considered individually. If you fulfil a contract you will make a profit; if you sell to a port you will make a slight loss. When at sea use N, E, S, W to move your ship while sailing.

D will display a ports location, C will permit passage through a canal and P will allow entry into port. Contracts and prices may change.

Randomly during a game at the end of the game the price of the ship will be included in the assessment.

```
  5 REM REYKJAVIK,FISH,79,145,L
IVERPOOL,MACHINERY,114,420,LENI
GRAD,IRON,117,125,STOCKHOLM,WOOD
,PULP,13,125,CAIRO,SILK,249,270
,BAHRAIN,OIL,289,130,CALCUTTA,JU
TE,290,140,CEYLON,TEA,355,155,TO
KYO,ELECTRICAL,229,310,CANBERRA,
MUTTON,392,155.
 10 REM LAGOS,COCOA,378,145,CAP
E TOWN,GOLD,546,650,JAMAICA,RUM
271,195,BEUNOS AIRES,BEEF,504,10
0,DETROIT,CARS,171,345,NEW ORLEA
NS,COTTON,235,190,WELLINGTON,FRUI
T,134,155,MOMBASA,COFFEE,384,155
,SUEZ,250,300,PANAMA,,335,300.
 15 R=257
 20 PRINT AT 10,6;"TRADE"
 25 LET A=10314
 30 DIM P$(20,12)
 35 DIM G$(20,10).
 40 DIM M(20)
 45 DIM C(20)
 50 FOR X=1 TO 20
 55 GOSUB 10E
 60 LET P$(X)=A$
 65 GOSUB 10E
 70 LET G$(X)=A$
 75 GOSUB 10E
 80 LET M(X)=VAL A$
 85 GOSUB 10E
 90 LET C(X)=VAL A$
```

(continued on page 177)

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(continued from page 175)

```
 95 NEXT X
 100 GOTO 140
 105 LET A$=""
 110 LET B=PEEK A
 115 LET A=A+1
 120 IF A=16744 THEN LET A=16706
 125 IF B=26 THEN RETURN
 130 LET A$=A$+CHR$ B
 135 GOTO 110
 140 SLOW
 145 PRINT AT 13,3;"HOW MANY PLA
YERS? (1-4)"
 150 INPUT I
 155 LET I=INT I
 160 IF I<1 OR I>4 THEN GOTO 150
 165 PRINT AT 15,5;"HOW MANY TUR
NS?"
 170 INPUT J
 175 LET J=INT J
 180 IF J<1 THEN GOTO 170
 185 DIM V(I,30)
 190 FOR X=1 TO I
 195 LET V(X,30)=100
 200 LET V(X,1)=300000
 205 LET V(X,2)=INT (RND*16)+1
 210 LET V(X,3)=M(V(X,2))
 215 NEXT X
 220 DIM B(3,I+3)
 225 FOR X=1 TO I+3
 230 LET Y=INT (RND*18)+1
 235 LET E=INT (RND*10)+1
 240 IF Y=E THEN GOTO 230
 245 LET F=INT (RND*900)+100
 250 LET B(1,X)=Y
 255 LET B(2,X)=E
 260 LET B(3,X)=F
 265 NEXT X
 270 LET NO=I
 275 GOSUB 1130
 280 PRINT
 285 FOR Z=1 TO J
 290 PRINT "TIME ELAPSED ";Z-1
 295 PRINT "TIME LEFT ";J-Z+1
 300 FOR Y=1 TO NO
 305 PRINT "PRESS A KEY"
 310 IF INKEY$="" THEN GOTO 310
 315 IF V(Y,3)=0 THEN GOTO 780
 320 CLS
 325 PRINT "PLAYER  ";Y
 330 PRINT AT 3,0;"MONEY  £";V(Y
,1)
 335 PRINT AT 5,0;"YOU HAVE A SH
IP ";
 340 IF V(Y,2)=0 THEN PRINT "AT
SEA"
 345 IF V(Y,2)<>0 THEN PRINT "IN
THE PORT OF ";P$(V(Y,2))
 350 IF V(Y,6)+V(Y,7)+V(Y,8)=0 T
HEN PRINT "YOU HAVE NO GOODS ABO
ARD"
 355 IF V(Y,6)+V(Y,7)+V(Y,8)=0 T
HEN GOTO 385
 360 PRINT AT 8,0;"ON BOARD YOU
HAVE:-"
 365 PRINT "GOODS","UNITS"
 370 FOR X=6 TO 8
 375 IF V(Y,X)<>0 THEN PRINT G$(
V(Y,X)),V(Y,X+3)
 380 NEXT X
 385 IF V(Y,2)=0 THEN GOTO 420
 390 PRINT AT 19,0;"DO YOU WISH
TO STAY IN PORT?"
 395 INPUT I$
 400 IF I$(1 TO 1)="Y" THEN GOTO
 795
 405 IF I$(1 TO 1)<>"N" THEN GOT
O 395
 410 LET V(Y,1)=V(Y,1)-200
 415 LET V(Y,2)=0
 420 LET E=INT (RND*10)+1
 425 PRINT "YOU HAVE ";E;" HOURS
"
 430 PRINT "PRESS N/L"
 435 INPUT I$
 440 LET PE=PEEK 16396+256*PEEK
16397
 445 GOSUB 1910
 450 FOR F=1 TO E
 455 LET G=PEEK (V(Y,3)+PE)
 460 POKE (V(Y,3)+PE),56
 465 LET M$=INKEY$
 470 IF M$="" THEN GOTO 465
 475 POKE V(Y,3)+PE,G
 480 IF M$<>"D" THEN GOTO 575
 485 CLS
 490 FAST
 495 FOR X=1 TO 20
 500 PRINT X,P$(X)
 505 NEXT X
 510 SLOW
 515 PRINT "ENTER NO."
 520 INPUT I
 525 LET I=INT I
 530 IF I<0 OR I>20 THEN GOTO 52
0
 535 GOSUB 1910
 540 LET H=PEEK (M(I)+PE)
 545 FOR X=1 TO 10
 550 POKE M(I)+PE,50
 555 POKE M(I)+PE,H
 560 NEXT X
 565 NEXT F
 570 GOTO 785
 575 IF M$<>"P" THEN GOTO 620
 580 FOR X=1 TO 18
 585 IF V(Y,3)=M(X) THEN GOTO 60
0
 590 NEXT X
 595 NEXT F
 600 GOTO 785
 605 LET V(Y,1)=V(Y,1)-(200+INT
(RND*100))
 610 LET V(Y,2)=X
 615 GOTO 795
 620 IF M$<>"C" THEN GOTO 650
 625 IF V(Y,3)=M(19)-33 THEN LET
V(Y,3)=M(19)
 630 IF V(Y,3)=M(19)+33 THEN LET
V(Y,3)=M(19)
 635 LET V(Y,3)=V(Y,3)-(V(Y,3)=M
(20)+1)+(V(Y,3)=M(20))
 640 LET V(Y,1)=V(Y,1)-400
 645 GOTO 760
 650 IF M$="N" AND V(Y,3)=M(19)+
33 THEN GOTO 760
 655 IF M$="S" AND V(Y,3)=M(19)-
33 THEN GOTO 760
 660 IF M$="E" AND V(Y,3)=M(20)
THEN GOTO 760
 665 IF M$="W" AND V(Y,3)=M(20)+
1 THEN GOTO 760
 670 LET DE=V(Y,3)-(M$="W")+(M$=
"E")-33*(M$="N")+33*(M$="S")
 675 IF DE/33=INT (DE/33) THEN L
ET DE=DE+(M$="E")-(M$="W")
 680 IF DE>725 THEN LET DE=DE-72
6
 685 IF DE<1 THEN LET DE=DE+726
 690 LET AD=PEEK (DE+PE)
 695 LET AV=G
 700 IF AD<128 THEN GOTO 745
 705 LET ZX=DE
 710 LET DE=AD
 715 LET AD=ZX
 720 IF M$="N" AND (DE=131 OR DE
=130 OR DE=129 OR AV=7 OR AV=132
OR AV=3) THEN GOTO 745
 725 IF M$="S" AND (AV=131 OR AV
=130 OR AV=129 OR DE=7 OR DE=132
OR DE=3) THEN GOTO 745
 730 IF M$="E" AND (AV=133 OR AV
=132 OR AV=129 OR DE=130 OR DE=7
OR DE=5) THEN GOTO 745
 735 IF M$="W" AND (DE=133 OR DE
=132 OR DE=129 OR AV=130 OR AV=7
OR AV=5) THEN GOTO 745
 740 GOTO 755
 745 NEXT F
 750 GOTO 765
 755 LET V(Y,3)=AD
 760 NEXT F
 765 CLS
 770 PRINT "THAT WAS THE LAST OF
YOUR MOVES AND YOU ARE NOT IN P
ORT YET"
 775 GOTO 1500
 780 NEXT Y
 785 NEXT Z
 790 GOTO 1755
 795 CLS
 800 PRINT "PRESS A KEY"
 805 IF INKEY$="" THEN GOTO 805
 810 CLS
 815 PRINT "THIS IS THE PORT OF
";P$(V(Y,2))
 820 PRINT "GOODS AVAILABLE ";G$
(V(Y,2))
 825 PRINT "AT A COST OF £";C(V(
Y,2))
 830 PRINT AT 4,0;"YOU CAN DO TH
E FOLLOWING"
 835 PRINT AT 6,0;"1 BUY GOODS";
AT 8,0;"2 SELL GOODS";AT 10,0;"3
DISPLAY CONTENTS OF SHIP";AT 12
,0;"4 PORT INFORMATION"
 840 PRINT AT 14,0;"5 LIST CURRE
NT CONTRACTS";AT 15,0;"6 REPAIRS
";AT 18,0;"7 END"
 845 LET LOSS=(100-RND*10)/100
 850 PRINT AT 21,0,"ENTER CHOICE
"
 855 INPUT I
 860 LET I=INT I
 865 CLS
 870 IF I<1 OR I>7 THEN GOTO 855
 875 IF I=1 THEN GOTO 915
 880 IF I=2 THEN GOTO 1210
 885 IF I=3 THEN GOTO 1075
 890 IF I=4 THEN GOTO 1175
 895 IF I=5 THEN GOSUB 1130
 900 IF I=6 THEN GOTO 1590
 905 IF I=7 THEN GOTO 775
 910 GOTO 800
 915 REM BUY
 920 LET AM=0
 925 FOR X=6 TO 8
 930 IF V(Y,X)>0 AND V(Y,X)<V(Y
,2) THEN GOTO 940
 935 LET AM=AM+(500-V(Y,X+3))
 940 NEXT X
 945 IF AM=0 THEN PRINT "YOU HAV
E NO ROOM ON YOUR SHIP"
 950 IF AM=0 THEN GOTO 800
 955 PRINT "THERE IS ROOM FOR ";
AM;" UNITS"
 960 PRINT "YOU HAVE £";V(Y,1)
 965 PRINT "HOW MANY UNITS DO YO
U WISH TO  BUY AT £";C(V(Y,2));
" PER UNIT"
 970 INPUT I
 975 LET I=INT I
 980 LET LC=INT ((I*(12*RND)+5)
/2)
 985 IF I<0 OR I>AM THEN GOTO 57
0
 990 IF I*C(V(Y,2))>=V(Y,1) THEN
GOTO 1005
 995 PRINT "YOU CANNOT AFFORD TH
AT MUCH"
 1000 GOTO 970
 1005 LET V(Y,1)=V(Y,1)-(I*C(V(Y,
2)))
 1010 FOR X=6 TO 8
 1015 IF V(Y,X+3)=500 OR (V(Y,X)
<>0 AND V(Y,X)<>V(Y,2))) THEN GO
TO 1055
 1020 IF I>(500-V(Y,X+3)) THEN GO
TO 1040
 1025 LET V(Y,X+3)=V(Y,X+3)+I
 1030 LET V(Y,X)=V(Y,2)
 1035 GOTO 1060
 1040 LET I=I-(500-V(Y,X+3))
 1045 LET V(Y,X+3)=500
 1050 LET V(Y,X)=V(Y,2)
 1055 NEXT X
 1060 PRINT "LOADING FEES £",LC
 1065 LET V(Y,1)=V(Y,1)-LC
 1070 GOTO 800
 1075 IF V(Y,6)+V(Y,7)+V(Y,8)<>0
THEN GOTO 1090
 1080 PRINT "THERE ARE NO GOODS O
N BOARD"
 1085 GOTO 800
 1090 PRINT "CONTENTS OF YOUR SHI
P"
 1095 PRINT "HOLD GOODS","AMOUNT"
 1100 FOR X=6 TO 8
 1105 IF V(Y,X)=0 THEN GOTO 1120
 1110 PRINT
 1115 PRINT X-5,TAB 5,G$(V(Y,X)),
V(Y,X+3)
 1120 NEXT X
 1125 GOTO 800
 1130 CLS
 1135 PRINT "LIST OF CONTRACTS"
 1140 PRINT "PORT";TAB 15;"IMPORT
";TAB 26;"AMOUNT"
 1145 PRINT
 1150 FOR X=1 TO NO+3
 1155 PRINT P$(B(1,X));TAB 15;G$(
B(2,X));TAB 26;B(3,X)
 1160 NEXT X
 1165 IF I=5 THEN GOTO 800
 1170 RETURN
 1175 CLS
 1180 PRINT "PORT                GOODS
  COST"
 1185 PRINT "----                -----
  ----"
 1190 FOR F=1 TO 18
 1195 PRINT P$(F);TAB 14;G$(F),TA
B 26;C(F)
 1200 NEXT F
 1205 GOTO 800
 1210 IF V(Y,6)+V(Y,7)+V(Y,8)<>0
THEN GOTO 1225
 1215 PRINT "YOU HAVE NO CARGO FO
R SALE"
 1220 GOTO 800
 1225 PRINT "HOLD GOODS","AMOUNT"
 1230 FOR X=6 TO 8
 1235 IF V(Y,X)=0 THEN GOTO 1250
 1240 PRINT
 1245 PRINT X-5,TAB 5;G$(V(Y,X)),
V(Y,X+3)
 1250 NEXT X
 1255 PRINT "ENTER HOLD NUMBER"
 1260 INPUT I
 1265 LET I=INT I
 1270 IF I<1 OR I>3 THEN GOTO 126
0
 1275 LET I=I+5
 1280 IF V(Y,I)=0 THEN GOTO 1280
 1285 PRINT "DO YOU WANT TO SELL
TO A  CONTRACT"
 1290 INPUT I$
 1295 IF I$(1 TO 1)="Y" THEN GOTO
 1365
 1300 PRINT "ENTER QUANTITY"
 1305 INPUT Q
 1310 LET Q=INT Q
 1315 IF Q<0 OR Q>V(Y,I+3) THEN G
OTO 1325
 1320 IF I$(1 TO 1)="Y" THEN GOTO
 1430
 1325 LET CO=INT (Q*C(V(Y,I))*LOS
S)
 1330 PRINT "YOU GET ";CO
 1335 LET V(Y,1)=V(Y,1)+CO
 1340 LET V(Y,I+3)=V(Y,I+3)-Q
 1345 IF V(Y,I+3)=0 THEN LET V(Y,
I)=0
 1350 PRINT "LOADING FEES ";(Q*5)
 1355 LET V(Y,1)=V(Y,1)-(Q*5)
 1360 GOTO 800
 1365 CLS
 1370 PRINT "NO. PORT";TAB 16;"IM
PORT";TAB 26;"AMOUNT"
 1375 FOR X=1 TO NO+3
 1380 PRINT X;TAB 3;P$(B(1,X));TA
B 16;G$(B(2,X));TAB 28;B(3,X)
 1385 NEXT X
 1390 PRINT "ENTER CONTRACT NO."
 1395 INPUT Q
 1400 LET Q=INT Q
 1405 IF Q<1 OR Q>NO+3 THEN GOTO
 1395
 1410 IF B(1,Q)=V(Y,2) OR B(2,Q)
<>V(Y,1) THEN GOTO 1420
 1415 GOTO 1300
 1420 PRINT "THE CONTRACT IS INVA
LID"
 1425 GOTO 1285
 1430 IF B(3,Q)=0 THEN PRINT "THA
T MUCH IS NOT REQUIRED"
 1435 IF B(3,Q)=0 THEN GOTO 1305
 1440 LET V(Y,I+3)=V(Y,I+3)-Q
 1445 LET CO=Q*C(V(Y,I))*(2.1-LOS
S)
 1450 LET CO=INT CO
 1455 LET CO=CO-(Q*5)
 1460 IF V(Y,I+3)=0 THEN LET V(Y,
I)=0
 1465 PRINT "AFTER UNLOADING FEES
 YOU HAVE ";"£";CO
 1470 LET V(Y,1)=V(Y,1)+CO
 1475 LET B(3,Q)=B(3,Q)-Q
 1480 IF B(3,Q)<>0 THEN GOTO 800
 1485 LET I=0
 1490 GOSUB 1550
 1495 GOTO 800
 1500 IF RND>.7 THEN GOSUB 1520
 1505 IF RND>.95 THEN GOSUB 1545
 1510 IF RND>.99 THEN GOSUB 1575
 1515 GOTO 780
 1520 FOR X=1 TO INT (RND*3+1)
 1525 LET Q=INT (RND*18+1)
 1530 LET C(Q)=INT (C(Q)*(90+(RN
D*20))/100)
 1535 NEXT X
 1540 RETURN
 1545 LET Q=INT (RND*(ND+3)+1)
 1550 LET B(1,Q)=INT (RND*18)+1
 1555 LET B(2,Q)=INT (RND*18)+1
 1560 IF B(1,Q)=B(2,Q) THEN GOTO
 1550
 1565 LET B(3,Q)=INT (RND*900)+10
0
 1570 RETURN
 1575 IF V(Y,2)<>0 THEN RETURN
 1580 PRINT "YOU ARE IN A STORM"
 1585 IF V(Y,9)+V(Y,10)+V(Y,11)>1
00 THEN GOTO 1545
 1590 PRINT "STRENGTH OF SHIP ";V
(Y,30)
 1595 IF V(Y,30)<25 THEN PRINT "Y
OU COULD SINK"
 1600 PRINT "DAMAGE SUSTAINED ";
 1605 LET DAM=INT (RND*25)
 1610 PAUSE 100
 1615 PRINT DAM
 1620 LET V(Y,30)=V(Y,30)-DAM
 1625 IF V(Y,30)>0 THEN RETURN
 1630 PRINT "YOUR SHIP HAS SUNK Y
OU ARE OUT  OF THE GAME"
 1635 LET V(Y,3)=0
 1640 RETURN
 1645 PRINT "IF YOU DUMP ALL YOUR
 CARGO YOU  WILL BE ABLE TO RIDE
 THE STORM  AND YOUR SHIP WILL N
OT BE  DAMAGED"
 1650 PRINT "DO YOU WISH TO TAKE
THIS  OPTION?"
 1655 INPUT I$
 1660 IF I$(1 TO 1)="N" THEN GOTO
 1590
 1665 IF I$(1 TO 1)<>"Y" THEN GOT
O 1655
 1670 FOR F=6 TO 11
 1675 LET V(Y,F)=0
 1680 NEXT F
 1685 RETURN
 1690 IF V(Y,30)=100 THEN PRINT "
YOU DO NOT NEED REPAIRS"
 1695 IF V(Y,30)=100 THEN GOTO 80
0
 1700 PRINT "YOU REQUIRE ";100-V(
Y,30);" REPAIRS","COST OF REPAIR
S £";100
 1705 PRINT "ENTER REPAIRS"
 1710 INPUT I
 1715 LET I=INT I
 1720 IF I<0 OR I>(100-V(Y,30)) T
HEN GOTO 1710
 1725 IF V(Y,1)<I*100 THEN PRINT
"YOU CANNOT AFFORD THE REPAIRS"
 1730 IF V(Y,1)<I*100 THEN GOTO 1
710
 1735 LET V(Y,1)=V(Y,1)-I*100
 1740 LET V(Y,30)=V(Y,30)+I
 1745 PRINT "REPAIRS REQUIRED=";1
00-V(Y,30)
```

(continued on page 183)

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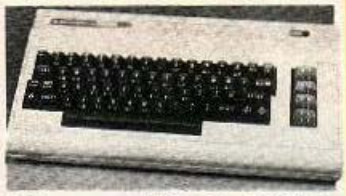

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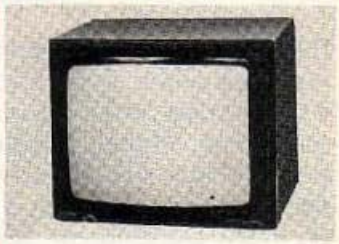

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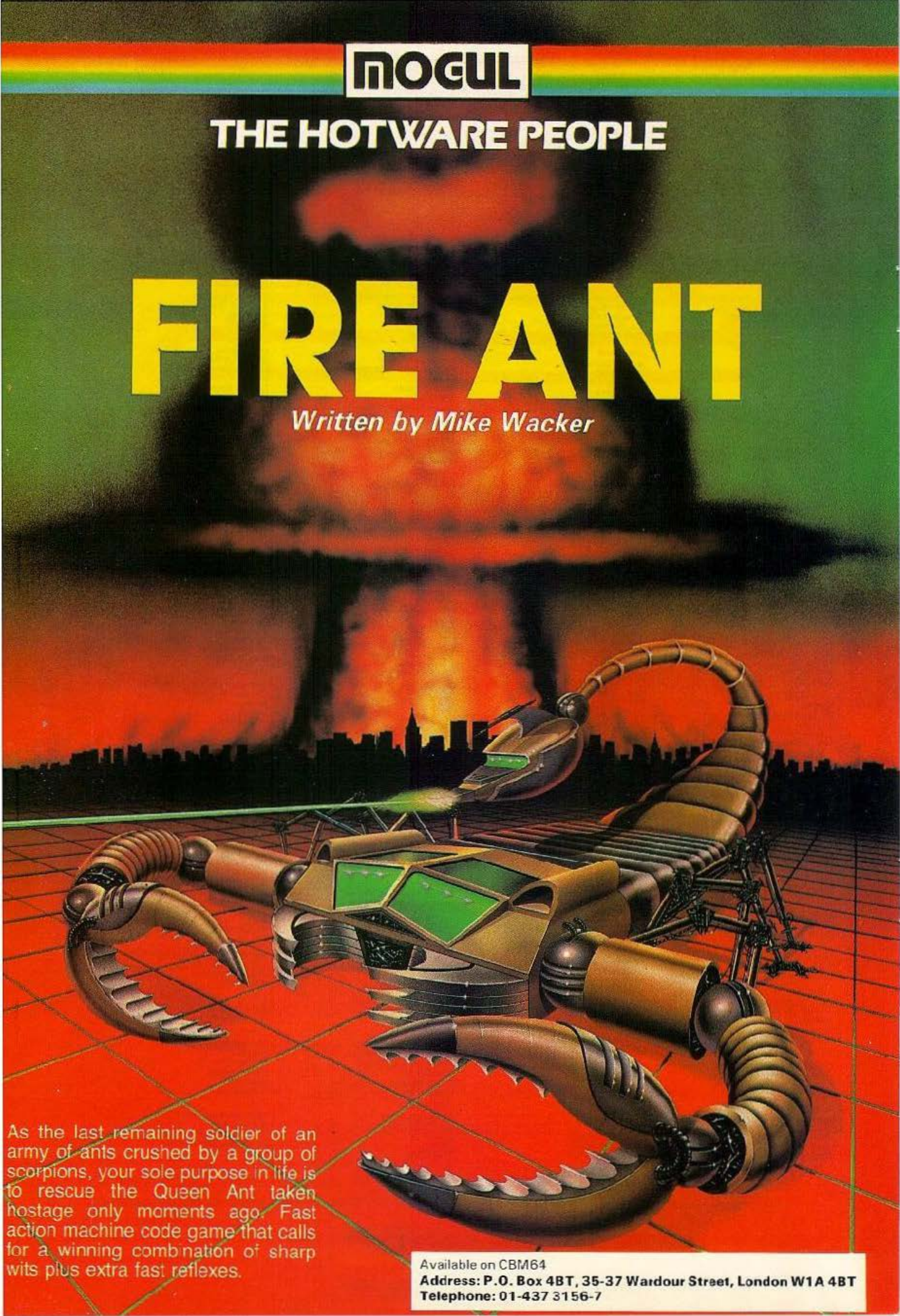
FIRE ANT

Written by Mike Wacker



As the last remaining soldier of an army of ants crushed by a group of scorpions, your sole purpose in life is to rescue the Queen Ant taken hostage only moments ago. Fast action machine code game that calls for a winning combination of sharp wits plus extra fast reflexes.

Available on CBM64

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(continued from page 177)

```
1750 GOTO 800
1755 PRINT "END OF GAME"
1760 FOR X=1 TO NO
1765 IF V(X,3)<>0 THEN LET V(X,1
3)=V(X,1)+150000
1770 IF V(X,3)=0 THEN GOTO 1795
1775 FOR F=6 TO 8
1780 IF V(X,F)=0 THEN GOTO 1790
1785 LET V(X,13)=V(X,13)+C(V(X,F
))*V(X,F+3)*.9
1790 NEXT F
1795 NEXT X
1800 CLS
1805 PRINT "RESULT AFTER ";J;" G
OES"
1810 FOR X=1 TO NO
1815 PRINT
1820 PRINT "PLAYER ";X
1825 PRINT "TOTAL=£";V(X,13)
1830 PRINT
1835 NEXT X
1840 PRINT AT 18,0;"DO YOU WISH
AN EXTENSION OF THISGAME?"
1845 INPUT I$
1850 IF I$(1 TO 1)="N" THEN GOTO
 1860
1855 IF I$(1 TO 1)<>"Y" THEN GOT
O 1845
1860 PRINT "HOW MANY EXTRA GOES?
"
1865 INPUT J
1870 CLS
1875 GOTO 285
1880 PRINT AT 21,0;"DO YOU WANT
ANOTHER GAME? (Y/N)"
1885 LET I$=INKEY$
1890 IF I$="Y" THEN CLS
1895 IF I$="Y" THEN RUN
1900 IF I$="N" THEN STOP
1905 GOTO 1885
1910 REM MAP
1915 CLS
1920 PRINT "
1925 PRINT "
1930 PRINT "
1935 PRINT "
1940 RETURN
```

Caterpillar

Richarch Arundale,
Leeds,
West Yorkshire.

BBC

CATERPILLAR is based on the popular arcade game Centipede. The caterpillar moves horizontally but drops down a line and changes direction whenever it reaches the edge of the screen or hits a mushroom. Your task is to kill off the caterpillar before it reaches the bottom of the screen and kills you.

The mushrooms can be destroyed by shooting them three times. Their colour changes according to the number of hits sustained — no hits — red, one hit — green, two hits — blue. However, spiders often spin down from their webs above the mushroom patch to drop more mushrooms. The spiders can be shot for bonus points, but do not get in their way — they are lethal.

A snail also joins in the fun, poisoning any mushrooms in its way. Both the snail and the poisoned mushrooms can be shot for bonus points, but if the caterpillar comes into contact with a poisoned mushroom it will die.

If you manage to shoot all the segments of the caterpillar then you move on to the next mushroom patch, which contains more mushrooms and all the usual creepy-crawlies and, of course, another caterpillar. You have three bugs with which to fight off the caterpillars.

When asked if you want instructions, type Y or N. However, the instructions are more of an introduction to the inhabitants of the mushroom patch than an explanation of the game.

The program allows the use of both keyboard and joysticks. Although you are not asked if you want to use joysticks, a check is made, so you can use either, and you can in fact change in the middle of a game. For those without joysticks, the Adval commands in Procmove and Procfire can be omitted. A word of warning for those with joysticks: make sure that the lever is centred when using the keyboard, otherwise the program will be responding to the joystick as well as the keyboard. The keyboard controls are Z to go left, X to go right, and Shift to fire.

The program itself is well-structured using procedures and the minimum number of Goto statements. The following is a list of procedures used and their main purpose.

PRCCmove : moves the bug.
PRCCfire: fires arrows and checks if they hit anything.
PRCCcaterpilar: moves caterpillar.
PRCCdown: moves caterpillar down a line.
PRCCpest checks what pest needs moving — snail or spider.
PRCCsnail: moves snail and poisons any mushrooms it passes over.
PRCCspider: moves spider and drops mushrooms.
PRCCscreen: sets up screen display.
PRCCclear: resets variables after clearing a screen.
PRCCdead: checks if last score is a highscore, displays high-score table.
PRCCinstructions: displays characters, instructions, and controls.
PRCCinit: sets up variables and defines envelopes.
PRCCchars: sets up user-defined characters.

```
   10 MODE2:PROCinit:PROCchars
   20 REPEAT:PROCinstructions
   30 REPEAT:PROCscreen
   40 REPEAT:PROCmove:PROCfire:PROCcaterpillar:PROCpes
t:UNTIL C% OR D%
   50 IF C% THEN PROCclear ELSE IF D% THEN PROCdead
   60 UNTIL L%=0:PROChiscores:UNTIL FALSE
   70 END
   80 DEFPROCmove
   90 IF (INKEY(-98) OR ADVAL(1) DIV 64>900) AND A%>63
 AND POINT(A%-32,16)=0 THEN MOVE A%,32:PRINT bug$:A%=A
%-64:MOVE A%,32:PRINT bug$:ENDPROC
  100 IF (INKEY(-67) OR ADVAL(1) DIV 64<200) AND A%<12
16 AND POINT(A%+96,16)=0 THEN MOVE A%,32:PRINT bug$:A%
=A%+64:MOVE A%,32:PRINT bug$:ENDPROC ELSE ENDPROC
  110 DEFPROCfire
  120 IF (INKEY(-1) OR (ADVAL(0) AND 1)=1) AND NOT F%
THEN F%=TRUE:BX%=A%:BY%=32:GCOL3,14:MOVE BX%,BY%:VDU 2
28:SOUND0,-10,6,1:J%=0:REPEAT:J%=J%+1:GOTO 140 ELSE IF
 NOT F% THEN ENDPROC
  130 J%=0:REPEAT:J%=J%-1:GCOL3,14:MOVE BX%,BY%:VDU228
:BY%=BY%+32:MOVE BX%,BY%:VDU228
  140 IF BY%>895 THEN MOVE BX%,BY%:VDU228:F%=FALSE:UNT
IL F%=FALSE:ENDPROC
  150 IF POINT(BX%+32,BY%+16)=1 THEN MOVE BX%,BY%:VDU2
28:MOVE BX%,BY%+32:PRINT RM$:MOVE BX%,BY%+32:PRINT GM$
:SOUND 0,-15,6,2:F%=FALSE:SC%=SC%+20:VDU4:PRINT TAB(6,
2);SC%:VDU5:UNTIL F%=FALSE:ENDPROC
  160 IF POINT(BX%+32,BY%+16)=2 THEN MOVE BX%,BY%:VDU2
28:MOVE BX%,BY%+32:PRINT GM$:MOVE BX%,BY%+32:PRINT BM$
:SOUND 0,-15,6,2:F%=FALSE:SC%=SC%+30:VDU4:PRINT TAB(6,
2);SC%:VDU5:UNTIL F%=FALSE:ENDPROC
  170 IF POINT(BX%+32,BY%+16)=4 THEN MOVE BX%,BY%:VDU2
28:MOVE BX%,BY%-32:PRINT BM$:SOUND 0,-15,6,2:F%=FALSE:
SC%=SC%+40:VDU4:PRINT TAB(6,2);SC%:VDU5:UNTIL F%=FALSE
:ENDPROC
  180 IF POINT(BX%+32,BY%+16)=10 THEN SOUND 2,2,140,1:
MOVE BX%,BY%:VDU228:MOVE BX%,BY%+32:PRINT spider$:F%=F
ALSE:P%=0:SC%=SC%+200:VDU4:PRINT TAB(6,2);SC%:VDU5:UNT
IL F%=FALSE:ENDPROC
  190 IF POINT(BX%+32,BY%+16)=11 THEN MOVE BX%,BY%:VDU
228:MOVE BX%,BY%+32:PRINT PM$:SOUND 0,-15,6,2:F%=FALSE
:SC%=SC%+100:VDU4:PRINT TAB(6,2);SC%:VDU5:UNTIL F%=FAL
SE:ENDPROC
  200 IF POINT(BX%+32,BY%+24)=14 THEN SOUND 1,2,150,1:
MOVE BX%,BY%:VDU228:MOVE BX%,BY%+32:PRINT snail$:P%=FA
LSE:F%=FALSE:SC%=SC%+500:VDU4:PRINT TAB(6,2);SC%:VDU5:
UNTIL F%=FALSE:ENDPROC
  210 IF POINT(BX%+32,BY%+16)<>5 THEN UNTIL J%=3:ENDPR
OC ELSE MOVE BX%,BY%:VDU228:K%=0:REPEAT:K%=K%+1:UNTIL
(SX%(K%)=BX% AND SY%(K%)=BY%+32)
  220 SOUND 1,2,100,1:MOVE SX%(S%),SY%(S%):PRINT C$:MO
VE SX%(S%),SY%(S%):PRINT RM$:SX%(S%)=0:SY%(S%)=0:S%=S%
-1:F%=FALSE:SC%=SC%+50:VDU4:PRINT TAB(6,2);SC%:VDU5:IF
 S%=0 THEN C%=TRUE:UNTIL F%=FALSE:ENDPROC ELSE UNTIL F
%=FALSE:ENDPROC
  230 DEFPROCcaterpillar
  240 MOVE SX%(S%),SY%(S%):PRINT C$:IF SY%(1)<32 THEN
D%=TRUE:ENDPROC
  250 IF S%>1 THEN FOR K%=S% TO 2 STEP -1:SX%(K%)=SX%(
K%-1):SY%(K%)=SY%(K%-1):NEXT
  260 SX%(1)=SX%(1)+SD%:IF POINT(SX%(1)+32,SY%(1)-16)=
-1 THEN PROCdown
  270 IF POINT(SX%(1)+32,SY%(1)-16)=1 OR POINT(SX%(1)+
32,SY%(1)-16)=2 OR POINT(SX%(1)+32,SY%(1)-16)=4 THEN P
ROCdown
  280 IF POINT(SX%(1)+32,SY%(1)-16)<>11 THEN 290 ELSE
MOVE SX%(S%),SY%(S%):PRINT C$:SX%(S%)=0:SY%(S%)=0:S%=S
%-1:SX%(1)=SX%(1)-SD%:MOVE SX%(1),SY%(1):PRINT C$:IF S
%=1 THEN C%=TRUE:ENDPROC ELSE ENDPROC
  290 IF POINT(SX%(1)+32,SY%(1)-16)=3 THEN MOVE SX%(1)
,SY%(1):PRINT C$:D%=TRUE:ENDPROC
  300 MOVE SX%(1),SY%(1):PRINT C$:ENDPROC
  310 DEFPROCdown
  320 SY%(1)=SY%(1)-32:SX%(1)=SX%(1)-SD%:SD%=-SD%
  330 IF POINT(SX%(1)+32,SY%(1)-16)=1 OR POINT(SX%(1)+
32,SY%(1)-16)=2 OR POINT(SX%(1)+32,SY%(1)-16)=4 THEN S
X%(1)=SX%(1)+SD%:GOTO 330
  340 ENDPROC
  350 DEFPROCpest
  360 IF P%=0 AND RND(100)=1 THEN P%=1:PX%=0:PY%=RND(6
```

(continued on next page)

(continued from previous page)

```
)*64+192:SOUND 1,1,100,9:MOVE PX%,PY%:PRINT snail$
  370 IF P%=0 AND RND(50)-1 THEN P%=2:SOUND 2,4,175,1:
AX%=(RND(20)-1)*64:AY%=92E:MOVE AX%,AY%:PRINT spider$
  380 IF P%=1 THEN PROCsnail:ENDPROC ELSE IF P%=2 THEN
 PROCspider:ENDPROC ELSE ENDPROC
  390 DEFPROCsnail
  400 MOVE PX%,PY%:PRINT snail$
  410 PX%=PX%+64:IF POINT(PX%+32,PY%-16)=1 THEN MOVE P
X%,PY%:PRINT RM$:MOVE PX%,PY%:PRINT PM$:GOTO 410
  420 IF POINT(PX%+32,PY%-16)=2 THEN MOVE PX%,PY%:PRIN
T BM$:MOVE PX%,PY%:PRINT PM$:GOTO 410
  430 IF POINT(PX%+32,PY%-16)=4 THEN MOVE PX%,PY%:PRIN
T BM$:MOVE PX%,PY%:PRINT PM$:GOTO 410
  440 IF POINT(PX%+32,PY%-16)=11 THEN MOVE PX%,PY%:PRI
NT PM$
  450 IF POINT(PX%+32,PY%-16)=-1 OR POINT(PX%+32,PY%-1
6)=5 THEN P%=FALSE:ENDPROC
  460 MOVE PX%,PY%:PRINT snail$:ENDPROC
  470 DEFPROCspider
  480 MOVE AX%,AY%:PRINT spider$
  490 AY%=AY%-32:IF POINT(AX%+32,AY%-16)=1 OR POINT(AX
%+32,AY%-16)=2 OR POINT(AX%+32,AY%-16)=4 OR POINT(AX%+
32,AY%-16)=11 THEN 490
  500 IF POINT(AX%+24,AY%-48)=14 THEN SOUND 2,2,140,1:
GCOL3,14:MOVE BX%,BY%:VDU228:F%=FALSE:P%=0:SC%=SC%+200
:VDU4:PRINT TAB(6,2);SC%:VDU5:ENDPROC
  510 IF POINT(AX%+32,AY%-16)=-1 THEN SOUND 2,0,0,0:P%
=0:ENDPROC
  520 IF POINT(AX%+32,AY%-16)=0 AND RND(5)=1 THEN MOVE
 AX%,AY%:PRINT RM$:GOTO 490
  530 IF POINT(AX%+32,AY%-16)=3 THEN D%=TRUE:ENDPROC
  540 MOVE AX%,AY%:PRINT spider$:ENDPROC
  550 DEFPROCscreen
  560 MOVE 0,1023:PRINT C$;C$;C$:MOVE 1088,1023:PRINT
C$;C$;C$:GCOL0,2:MOVE 310,1017:PRINT"CATERPILLAR":GCOL
0,3:MOVE 300,1023:PRINT"CATERPILLAR"
  570 VDU4:PRINT TAB(0,2);"SCORE ";SC%;TAB(12,2);"LIVE
S ";L%;TAB(0,3);"HIGH ";H%(1);TAB(12,3);"SHEET ";sheet
%:VDU5
  580 FOR K%=1 TO 35+sheet%:N%=(RND(20)-1)*64:M%=(27-R
ND(25))*32:MOVE M%,N%:PRINT RM$:NEXT
  590 MOVE A%,32:PRINT bug$:FOR K%=1 TO 12:MOVE BX%(K%
),BY%(K%):PRINT C$:NEXT
  600 ENDPROC
  610 DEFPROCclear
  620 SOUND 2,3,120,1:sheet%=sheet%+1:F%=FALSE:C%=FALS
E:D%=FALSE:P%=0:RESTORE 870:FOR K%=1 TO 12:READ SX%(K%
),BY%(K%):NEXT:S%=12:SD%=64
  630 CLS:ENDPROC
  640 DEFPROCdead
  650 SOUND 2,4,100,1:TIME=0:REPEAT UNTIL TIME>250:SOU
ND 2,0,0,0
  660 D%=FALSE:RESTORE 870:FOR K%=1 TO 12:READ SX%(K%)
,BY%(K%):NEXT:S%=12:SD%=64:L%=L%-1:F%=FALSE:P%=0
  670 CLS:ENDPROC
  680 DEFPROChiscores
  690 VDU4:IF SC%<=H%(5) THEN 710 ELSE PRINT TAB(5,3);
"A HI-SCORE":K%=0:REPEAT:K%=K%+1:UNTIL SC%>H%(K%):*FX1
5,1
  700 J%=5:REPEAT:H%(J%)=H%(J%-1):H$(J%)=H$(J%-1):J%=J
%-1:UNTIL J%=K%:H%(K%)=SC%:INPUT TAB(0,10)"Name ",H$(K
%):H$(K%)=LEFT$(H$(K%),8)
  710 CLS:VDU5:GCOL0,2:MOVE 320,928:PRINT"HI-SCORES":G
COL0,3:MOVE 312,932:PRINT"HI-SCORES":VDU4:FOR K%=1 TO
5:PRINT TAB(0,K%*4+4);K%;SPC(2);H%(K%);SPC(3);H$(K%):N
EXT
  720 PRINT TAB(3,20);"PRESS SPACE BAR":REPEAT UNTIL G
ET=32:CLS:VDU5:SC%=0:L%=3:A%=576:sheet%=1:ENDPROC
  730 DEFPROCinstructions
  740 VDU5:GCOL0,2:MOVE 266,515:PRINT"INSTRUCTIONS?":G
COL0,3:MOVE 256,519:PRINT"INSTRUCTIONS?":REPEAT:G$=GET
$:UNTIL G$='Y' OR G$="N":CLS:IF G$='N' THEN ENDPROC
  750 GCOL0,2:MOVE 310,986:PRINT'CATERPILLAR":GCOL0,3:
MOVE 300,991:PRINT"CATERPILLAR":MOVE 100,900:PRINT bug
$:MOVE 400,900:PRINT"BUG":MOVE 100,800:PRINT C$;C$;C$;
C$:MOVE 400,800:PRINT"CATERPILLAR"
  760 MOVE 100,700:PRINT snail$:MOVE 400,700:PRINT"SNA
IL":MOVE 100,600:PRINT spider$:MOVE 400,600:PRINT"SPID
ER":MOVE 100,500:PRINT RM$;GM$;BM$;PM$:MOVE 400,500:PR
INT"MUSHROOMS"
  770 MOVE 100,200:PRINT"PRESS SPACE BAR":REPEAT UNTIL
 GET=32:CLS:GCOL0,21:MOVE 266,954:PRINT"CATERPILLAR":G
COL0,3:MOVE 256,959:PRINT"CATERPILLAR":VDU4
  780 PRINT TAB(1,6);"Kill off the""caterpillar befo
re""":it kills you.'''" Beware the spider"'"as it cr
awls down"'"the screen dropping"'"mushrooms , and th
e"'"snail which poisons"'"the mushrooms."
  790 PRINT'''"PRESS SPACE BAR":REPEAT UNTIL GET=32:CL
S:VDU5:GCOL0,2:MOVE 266,954:PRINT"CATERPILLAR":GCOL0,3
:MOVE 256,959:PRINT'CATERPILLAR":VDU4
  800 PRINT TAB(5,5);"CONTROLS";TAB(2,10);"Z          L
EFT";TAB(2,12);"X          RIGHT";TAB(2,14);"SHIFT
FIRE";TAB(3,20);"or  joysticks"'"PRESS SPACE BAR":RE
PEAT UNTIL GET=32:CLS:VDU5:ENDPROC
  810 DEFPROCinit
  820 DIM SX%(12),SY%(12):RESTORE 870:FOR K%=1 TO 12:R
EAD SX%(K%),SY%(K%):NEXT
  830 DIM H%(5),H$(5):FOR K%=1 TO 5:H%(K%)=1000:H$(K%)
="B B C":NEXT
  840 A%=576:F%=FALSE:sheet%=1:S%=12:D%=FALSE:SD%=64:C
%=FALSE:SC%=0:L%=3:P%=0
  850 ENVELOPE 1,1,5,-5,-5,50,25,25,126,0,0,-5,126,0:E
NVELOPE 2,133,8,4,8,3,1,1,126,0,0,-10,126,0:ENVELOPE 3
,2,8,-1,-1,8,200,200,126,-1,-1,-1,126,10:ENVELOPE 4,8,
10,6,-1,0,0,255,109,-1,0,-1,126,126
  860 ENDPROC
  870 DATA 704,864,640,864,576,864,512,864,448,864,384
,864,320,864,256,864,192,864,128,864,64,864,0,864
  880 DEFPROCchars
  890 VDU23,224,0,24,52,60,110,122,0,0,0,23,225,0,0,8,
0,16,4,24,24
  900 RM$=CHR$18+CHR$3-CHR$1+CHR$224+CHR$8+CHR$18+CHR$
3+CHR$7+CHR$225:GM$=CHR$13+CHR$3+CHR$2+CHR$224+CHR$8+C
HR$18+CHR$3+CHR$7+CHR$225
  910 BM$=CHR$18+CHR$3-CHR$4+CHR$224+CHR$8+CHR$18+CHR$
3-CHR$7+CHR$225:PM$=CHR$13+CHR$3+CHR$11+CHR$224+CHR$8+
CHR$18+CHR$3+CHR$7+CHR$225
  920 VDU23,226,24,60,126,255,255,24,0,0,23,227,24,36,
66,165,129,195,66,66
  930 bug$=CHR$18+CHR$3+CHR$3+CHR$226+CHR$8+CHR$18+CHR
$3+CHR$2+CHR$227
  940 VDU23,228,0,16,56,16,16,16,16,0
  950 VDU23,229,0,0,24,255,255,24,66,66,23,230,0,24,10
2,0,0,102,90,66
  960 C$=CHR$18+CHR$3+CHR$5+CHR$229+CHR$8+CHR$18+CHR$3
+CHR$6+CHR$230
  970 VDU23,231,0,0,0,0,1,127,254,0,23,232,0,56,124,12
4,56,0,0,0
  980 snail$=CHR$18+CHR$3+CHR$9+CHR$231+CHR$8+CHR$18+C
HR$3+CHR$14+CHR$232
  990 VDU 23,233,0,130,124,214,254,124,84,130,23,234,0
,130,0,40,0,16,84,130
 1000 spider$=CHR$18+CHR$3+CHR$10+CHR$233+CHR$8+CHR$18
+CHR$3+CHR$12+CHR$234
 1010 ENDPROC
```

File saver

F D Rose,
Stoke Bishop,
Bristol

CBM-64

UNLIKE THE SPECTRUM with its Save Code command, the CBM-64 lacks the facility for saving a portion of memory from Basic. This program provides such a utility. It allows you to save any stretch of memory, specifying the start address, the finish address, file-name, device number, and secondary address. The device number will usually be 1 for tape saving or 8 for disc saving.

Once you have typed the program in run it and wait for it to Poke in a small machine-code routine. You will then be asked to specify addresses and device number. If you give 1 as your secondary address you can reload the file using Load; giving a secondary address of zero means that you will have to use the command Load "",1,1. To save a file whether it be data or a machine-code program simply enter SYS 49152.

```
1 INPUT"FILENAME";F$
2 F$=LEFT$(F$,8)
3 FORN=1 TO LEN(F$):POKE819+N,ASC(MID$(F$,N,1)):NEXT
4 INPUT"START ADDRESS";SA
5 INPUT"END ADDRESS";EA
6 INPUT"DEVICE NO.";DN
7 INPUT"SECONDRY ADDRESS";ES
8 II=49152
9 I=49152
10 READ A$
20 IF A$="-" THEN 200
30 AL$=LEFT$(A$,1):AR$=RIGHT$(A$,1)
40 IF ASC(AL$)<65 THEN D=VAL(AL$)*16:GOTO 60
50 I=(ASC(AL$)-55)*16
60 IF ASC(AR$)<65 THEN D=D+VAL(AR$):GOTO 80
70 I=D+ASC(AR$)-55
80 POKE I,D:I=I+1:GOTO 10
100 DATA A9,08,A2,08,A0,FF,20,BA,FF,A9,01,A2,34,A0,03,20,BD,FF,A9,FF,85,FE
110 DATA A9,FF,85,FC,A2,00,A0,FF,A9,F3,20,D0,FF,60,-
200 POKE II+3,DN:POKEII+5,ES
210 POKE II+10,LEN(F$)
220 A=INT(SA/256):POKEII+19,SA-A*256:POKEII+23,A
230 A=INT(EA/256):POKEII+27,EA-A*256:POKEII+29,A
```

Tape back-up

J Press,
Biggleswade,
Bedfordshire.

SPECTRUM

THIS MACHINE-CODE routine resides in the printer buffer and will allow back-up copies to be made of almost any program on both 16K and 48K versions of the Spectrum. The routine is compatible with the ZX Interface 1 and is easy to use.

Type in the program as listed and then enter Run. The program will Poke the machine code into place and will then save it to tape. If you have made a typing mistake, the message Sumcheck Error will be displayed, in which case you should check the Data statements for errors.

The cloning routine is loaded by entering:

LOAD "JPCLONE" CODE

Once the code has been loaded, either:

RANDOMISE USR 23293

You will be presented with a menu of the three options available to you.

The program to be backed-up must be copied block by block — Spectrum programs usually consist of two or three data blocks, one of which may be headerless. Press 1 for a normal block — with a header — or 2 if the block is headerless. Put the program to be copied into the cassette recorder and start it playing. If option 1 was selected, the name of the block will be displayed. Once the block has been loaded the normal Start tape and press any key message will be displayed, you should then put the back-up tape into the recorder, start it recording and press any key on the Spectrum. When the block has been saved the menu will be redisplayed so that you can copy another data block or press 3 to return to Basic.

```
  5 LET a=0
  6 RESTORE 50
 10 FOR i=23296 TO 23296+238
 20 READ c: POKE i,c: LET a=a+c
 30 NEXT i
 35 PRINT ' a
 40 IF a<>22885 THEN  PRINT '"SUMCHECK ERROR": STOP
 45 SAVE "JPCLONE"CODE 23296,239
 50 DATA 62,2,205,1,22,6,22,205,68,14,17,184,91,1,55,0
 70 DATA 205,60,32,33,0,91,229,62,247,219,254,79,230
 90 DATA 1,40,12,121,230,2,40,66,121,230,4,32,237,225,201
110 DATA 62,49,205,166,91,175,55,221,33,239,91,17,17,0
120 DATA 205,2,8,58,239,91,17,192,9,205,10,12,1,10,0,17
150 DATA 240,91,205,60,32,55,62,255,237,91,250,91,221,42
160 DATA 10 ,92,205,2,8,42,101,92
170 DATA 22 ,33,239,91,195,112
180 DATA 9,62,50,205,166,91,55,62
190 DATA 255,221,42,101,92,17
200 DATA 255,239,205,86,5,221,229,225,237,91,101,92,175,237,82,
34
210 DATA 250,91,62,253,205,1,22,175,17,161,9,205,10,12,253,203
220 DATA 2,238,205,212,21,62,255,221,42,101,92,237,91,250,91,19
5
230 DATA 194,4,215,1,8,0,17,176,91,195,60,32
240 DATA 22,1,0,6,6,22,0,C,22,3,0,127,74,80,39,56,52,13,49,45
250 DATA 78,79,82,77,65,76,32,67,79,80,89,13,50,45,72,69,65,68,
69,82,76,69,83,83
260 DATA 32,67,79,80,89,13,51,45,69,78
270 DATA 68,13,79,80,84,73,79,78,63
```

3D graph program

Robert Driver,
Leeds,
West Yorkshire.

BBC

HERE IS A 3D-Graph program which will run on a 16K or 32K BBC Micro. It will plot any section of any function for Y in terms of X and Z as a wire-frame or surface diagram with or without axes — the axes option is only offered if the chosen values for X and Z include the origin.

```
  10REM ****************
  20REM *              *
  30REM *    3D-GRAPH  *
  40REM *   WRITTEN BY *
  50REM * ROBERT  DRIVER *
  60REM * COPYRIGHT 1984 *
  70REM *              *
  80REM ****************
  90:
 100:
 110ON ERROR GOTO 1360
 120MODE7
 130PROCINIT
 140REPEAT:REM                    MAIN
 150MODE7
 160PROCINPUT:REM                 PROGRAM
 170PROCSCALE
 180MODE4:REM                     CONTROL
 190PROCPLOT
 200UNTIL FALSE:REM                LOOP
 210END
 220:
 230:
 240DEF PROCINPUT
 250VDU23,1,1;0;0;0;
 260PRINT"EXPRESSION FOR Y IN TERMS OF X AND Z:";PRIN
TCHR$13;E$
 270INPUTA$:IF A$<>""THEN >=0:Z=0:Y=EVAL(A$):E$=A$
 280PRINT"LOWEST VALUE FOR X:",CHR$13;LX$:INPUTA$:IF
 A$<>""THEN LX$=A$
 290PRINT"HIGHEST VALUE FOR X:",CHR$13;HX$
 300INPUTA$:IF A$<>""THEN HX$=A$
 310IF EVAL(LX$)>=EVAL(HX$)THEN FOR J=1 TO 35-LEN(H$
):VDU127:NEXT:GOTO300
 320PRINT"LOWEST VALUE FOR Z:",CHR$13;LZ$:INPUTA$:IF
 A$<>""THEN LZ$=A$
 330PRINT"HIGHEST VALUE FOR Z:",CHR$13;HZ$
 340INPUTA$:IF A$<>""THEN HZ$=A$
 350IF EVAL(LZ$)>=EVAL(HZ$)THEN FOR J=1 TO 35-LEN(HZ$
):VDU127:NEXT:GOTO340
 360PRINT"NUMBER OF STEPS ALONG X-AXIS:",CHR$13;X$:
INPUTA$:IF A$<>""THEN X$=A$
 370PRINT"NUMBER OF STEPS ALONG Z-AXIS:",CHR$13;Z$:
INPUTA$:IF A$<>""THEN Z$=A$
 380PRINT"DO YOU WANT A WIRE FRAME OR SURFACE""DIAGR
AMM",CHR$13;F$, A$=GET$:IF A$="W"OR A$="S" THEN F$=A$:
PRINT F$
 390XSTART=EVAL(LX$):XSTOP=EVAL(HX$):ZSTART=EVAL(HZ$)
:ZSTOP=EVAL(LZ$):XSTEP=(XSTOP-XSTART)/ABS(EVAL(X$)) Z
STEP=(ZSTART-ZSTOP)/ABS(EVAL(Z$))
 400IF(XSTART<=0 AND XSTOP>=0)OR(ZSTART>=0 AND ZSTOP<
=0) THEN PRINT"DO YOU WANT AXES (Y/N)",CHR$13;A$:IF A$=
GET$:IF A$="Y"OR A$="N" THEN A$=A$:PRINT A$ ELSE A$="N
"
 410 PRINT"PLEASE WAIT. WHEN THE GRAPH IS FINISHED PR
ESS THE APPROPRIATE KEY FOR THE      NUMBER OF TIMES
YOU WANT IT TO BE          PRINTED, OR ANY NON-NUMERIC KE
Y TO          RETURN TO THIS MENU."
 420ENDPROC
 430:
 440:
 450DEF PROCSCALE
 460XSTART=XSTEP*(:XSTART*100) DIV (XSTEP*100):XSTOP
=XSTOP*(:XSTOP*.00) DIV (XSTEP*100)):ZSTART=ZSTEP*((ZS
TART*100) DIV (ZSTEP*100)):ZSTOP=ZSTEP*((ZSTOP*100) DI
V (ZSTEP*100))
 470 ZBIG=1200/((ZSTART-ZSTOP)*2+(XSTOP-XSTART)):YAL
L=(2*XSTART-ZSTOP)*ZBIG:X=XSTART:Z=ZSTART:YLARGE=EVAL(
E$):YSMALL=YLARGE:YLARGE=ZSTART:ZYSMALL=ZBIG:NX=
 480 FOR Z=ZSTOP TO ZSTART STEP ZSTEP
 490 FOR X=XSTART TO XSTOP STEP XSTEP:Y=EVAL(E$):IF Y
>=YLARGE THEN YLARGE=Y:ZYLARGE=Z
 500 IF Y<=YSMALL THEN YSMALL=Y:ZYSMALL=Z
 510 NEXT:NEXT:YBIG=(1023-((ZYLARGE-ZYSMALL)*ZBIG))/(
YLARGE-YSMALL):YTALL=-YSMALL*YBIG-ZYSMALL*ZBIG:Y3IG=Z*
YBIG/3
 520ENDPROC
 530:
 540:
 550DEF PROCPLOT
 560VDU29,-XTALL;YTALL;
 570VDU23,1,0;0;0;0;
 580IF A$="Y" AND F$="S" THEN PROCAXISGRAPH ELSE PROC
GRAPH:IF A$="Y" THEN PROCAXIS
 590A=GET-48:IF A>0 AND A<10 THEN PROCDUMP(A)
 600ENDPROC
 610:
 620:
 630DEF PROCGRAPH
 640FOR Z=ZSTART TO ZSTOP-ZSTEP STEP -ZSTEP
 650PROCLINE(Z):NEXT:MOVEFNX(XSTART,ZSTOP):FNY()START
,ZSTOP)
 660FOR X=(XSTART+XSTEP TO XSTOP STEP XSTEP:DRAWFNX(),
ZSTOP):FNY(),ZSTOP):NEXT
 670ENDPROC
 680:
 690:
 700DEF PROCAXISGRAPH
 710MOVEZSTOP:DRAWZSTART,ZBIG*ZSTART:DRAW2000,2000
 720IF ZSTART>0 THEN FOR Z=ZSTART TO ZSTOP STEP -ZSTE
P:PROCAXISLINE()):NEXT
 730MOVE-2000,0:DRAW2000,0:MOVE0,-2000:DRAW0,2000
 740IF ISTOP<0 THEN FOR Z=0 TO ZSTOP+ZSTEP STEP -ZSTE
P:PROCAXISLINE()):NEXT
 750MOVEFNX(XSTART,ZSTOP),FNY(XSTART,ZSTOP):FOR X=XST
ART+XSTEP TO XSTOP STEP XSTEP:DRAWFNX(X,ZSTOP),FNY(X Z
STOP):NEXT:MOVEZBIG+ZSTOP,ZBIG+ZSTOP:DRAW-2000,-2000
 760ENDPROC
 770:
 780:
 790DEF PROCDUMP(A)
 800FOR T=. TO A
 810VDU2,1,27,1,76,1,2
 820FOR LX=312 TO 0 STEP -8:VDU1,28,1,80,1,0,1,27,1 7
1,1,1,1,256
 830FOR CX=0 TO 4920 STEP 320:FOR B4=HIMEM+LX+CX TO H
IMEM+LX-CX+7:VDU1,?B4:NEXT:NEXT
 840VDU1,10:NEXT:VDU1,28,27,1,76,1,3,1,10
 850FOR J%=1 TO (80-LEN(E$)) DIV 2:VDU1,32:NEXT:FOR J
%=1 TO LEN(E$):VDU1,ASC(MID$(E$,J%,1)):NEXT:VDU1,10,1,
10,3:NEXT
 860ENDPROC
```

(continued on page 187)

In the menu, the last function for Y, values for X and Z etc. are shown and can be left unaltered simply by pressing Return, or changed by typing in the new value. All the expressions are entered as strings and then EVALed. This is especially useful for trigonometrical functions where the values for X and Z may need to be interms of PI e.g., −2*PI.

The menu is virtually foolproof: it will not accept a highest value for X lower than the lowest value for X. However, make sure that your function for Y is in terms of X and Z, and that there is no possibility of division by zero. There is an error-handling routine, but it is rather annoying to come and see how your wonderful graph is coming along, only to find that there was something wrong with the function.

The graph is then scaled by Procscale which usually does its job, but for extra-special graphs some fiddling around may be called for: YTALL is the height of the origin above the bottom of the screen, and YBIG is the number of graphics units per Y unit.

The graph is then plotted in mode 4 by Procplot. This procedure calls various other procedures according to whether a wire-frame or surface diagram is called for, and whether axes are wanted. Basically it calls Procline or Procaxisline from within a loop, which in turn call Procfill or Procsquare from within a loop.

If required the graph can be dumped up to nine times on to a printer by Procdump. This was written for a Seikosha GP-250X but it should run on any Seikosha or Acorn graphics printer with perhaps a little modification. The VDUs at the beginning are to specify linefeed and graphics mode, and to print lots of spaces so that the graph is printed in the middle of the paper. Then the graph is plotted sideways. This is because a byte of screen memory represents a row of eight pixels, whereas a byte sent to the printer is printed as a column of eight dots.

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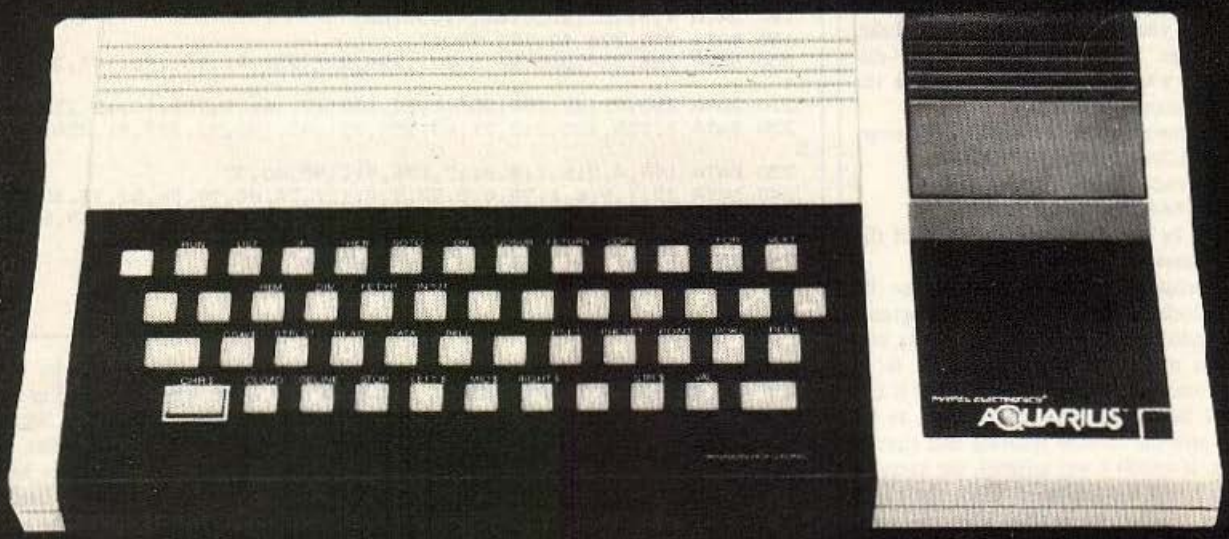

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(continued from page 185)

```
  870:
  880:
  890DEF PROCSQUARE(X,Z)
  900MOVEFNX(X,Z),FNY(X,Z):DRAW FNX(X,Z-ZSTEP),FNY(X,Z
-ZSTEP):MOVEFNX(X,Z),FNY(X,Z):DRAWFNX(X+ZSTEP,Z),FNY(X
+XSTEP,Z)
  910ENDPROC
  920:
  930:
  940DEF PROCFILL(X,Z)
  950MOVEFNX(X,Z),FNY(X,Z):MOVEFNX(X-XSTEP,Z),FNY(X+XS
TEP,Z):FOR C=0 TO STEP,FNY(X+XSTEP,Z-ZSTEP),FNY(X+XSTEP
,Z-ZSTEP):MOVEFNX(X,Z-ZSTEP),FNY(X,Z-ZSTEP):PLOT85,FNX
(X,Z),FNY(X,Z):GCOL0,1:DRAW FNX(X,Z-ZSTEP),FNY(X,Z-ZST
EP)
  960MOVEFNX(X,Z),FNY(X,Z):DRAWFNX(X-XSTEP,Z),FNY(X+XS
TEP,Z)
  970ENDPROC
  980:
  990:
1000DEF PROCLINE(Z)
1010FOR X=XSTART TO XSTOP-XSTEP STEP XSTEP
1020IF F4="B" THEN PROCFILL(X,Z ELSE PROCSQUARE(X,Z)
1030NEXT:DRAWFNX(XSTOP,Z-ZSTEP) FNY XSTOP,Z-ZSTEP)
1040ENDPROC
1050:
1060:
1070DEF PROCAXISLINE(Z)
1080IF XSTART<0 THEN FOR X=XSTART TO -XSTEP STEP XSTE
P:PROCFILL(X,Z):NEXT
1090MOVEZERO+Z.ZERO+Z:DRAWZERO+(Z-ZSTEP),ZERO+(Z-ZSTE
P)
1100IF XSTOP>0 THEN FOR X=0 TO XSTOP-XSTEP STEP XSTEP
:PROCFILL(X,Z):NEXT
1110MOVEFN(XSTOP,Z),FNY(XSTOP,Z):DRAWFNX(XSTOP,Z-ZST
EP),FNY(XSTOP,Z-ZSTEP)
1120ENDPROC
1130:
1140:
1150DEF PROCaxes
1160MOVE-2000,0:DRAW2000,0:MOVE-2000,-2000:DRAW2000,2
000:MOVE0,-2000:DRAW0,2000
1170ENDPROC
1180:
1190:
1200DEF PROCINIT
1210FOR Z%=1 TO 2:PRINTCHR$(141);"                    3D-BRA
PH":NEXT
1220PRINT
1230PRINT" This program will plot a two-          dim
ensional representation of a three- dimensional graph
. It will also print  the graph up to nine times on a
 printer.There is a demonstration graph in the"
1240PRINT"program, which you can see by pressing  RET
URN after each section in the menu.  The computer will
 then use the values  which are flashing. If you want
 to use  your own values, you simply type them in"
1250VDU11:PRINT"in the appropriate places. Your value
s  will then override the flashing ones, so the next ti
me the menu appears you can  decide for each one wheth
er to change it or leave it as it is."
1260PRINT" The only problem with this program is the
t it takes rather a long time,  especially if you
use a large number of steps, which is necessary if yo
u want aesthetic graphs."
1270E4="CCS(BGR(X+X-Z+Z))/(BGR(X+X-Z+Z)+2)":LX$="-2*P
I"+X4+"/2+PI":LZ$="-2*PI":HI$="2*PI":XS$="24":ZS$="24"
:F4$="B":s$="N"
1280PRINT                    PRESS ANY KEY":A$=GET$
1290ENDPROC
1300:
1310:
1320DEF FNX(X,Z)=Z*ZBIG+X*(BIG+Z
1330DEF FNY(X,Z)=Z*ZBIG+YBIG*EVAL(E$)
1340:
1350:
1360REM *** ERROR HANDLING ROUTINE ****
1370IF ERR>17 THEN MODE7:PRINT"THERE IS SOMETHING WR
ONG WITH THE       EQUATION YOU HAVE ENTERED. PLEASE C
HECK IT AND TRY AGAIN.":A=GET
1380GOTO140
1390:
1400REM ***********************************
```

Vic-20 auto line numbering.

```
10 DATA 169,40,133,0,133,2,133,3
20 DATA 133,4,169,49,133,1,120,169
30 DATA LB,141,20,3,169,HB,141,21
40 DATA 3,88
50 DATA 96,165,211,201,1,208,6,169
60 DATA 32,197,197,240,3,76,191,234
70 DATA 169,0,133,211,169,48,162,4
80 DATA 213,0,208,5,202,224,255,208
90 DATA 247,232,134,198,160,0,136,181
100 DATA 0,153,119,2,200,202,224,255
110 DATA 208,245,230,198,169,32,153,119
120 DATA 2,162,1,246,0,169,58,213
130 DATA 0,208,9,169,48,149,0,232
140 DATA 224,5,208,239,76,191,234
150 Z=0
151 T=PEEK(55)+256*PEEK(56)
152 T=T-105:LB=(T/256-INT(T/256))*256:HB=INT(T/256)
153 POKE55,LB:POKE56,HB
154 LB=LB+27:IFLB>255THENLB=LB-256:HB=HB-1
160 FOR X=T TO T+104
170 READ Y$
172 IF Y$="HB" THEN Z=Z+HB:POKEX,HB:NEXT
174 IF Y$="LB" THEN Z=Z+LB:POKEX,LB:NEXT
176 Y=VAL(Y$):Z=Z+Y:POKEX,Y
180 NEXT X
190 IF Z<>13063+LB+HB THEN PRINT "ERROR IN DATA -
    PLEASE RE-ENTER":END
200 PRINT "SYS(";T;") TO START"
210 PRINT "SYS(";T+3;") OR RUN-  STOP/RESTORE TO END"
220 PRINT "SYS(";T+14;") TO RESUME"
230 SYS(T)
240 NEW
```

CBM-64 auto line numbering.

```
10 DATA 169,48,133,2,133,4,133,5
20 DATA 133,6,169,49,133,3,120,169
30 DATA 27,141,20,3,169,192,141,21
40 DATA 3,88
50 DATA 96,165,211,201,1,208,6,169
60 DATA 60,197,197,240,3,76,49,234
70 DATA 169,0,133,211,169,48,162,4
80 DATA 213,2,208,5,232,224,255,208
90 DATA 247,232,134,198,160,0,136,181
100 DATA 2,153,119,2,200,202,224,255
110 DATA 208,245,230,198,169,32,153,119
120 DATA 2,162,1,246,2,169,58,213
130 DATA 2,208,9,169,48,149,2,232
140 DATA 224,5,208,239,76,49,234
150 Z=0
160 FOR X=49152 TO 49256
170 READ Y:Z=Z+Y POKEX,Y
180 NEXT X
190 IF Z<>13045 THEN PRINT "ERROR IN DATA - PLEASE RE-ENTER":END
200 REM ** SYS (49152) TO START **
210 REM ** SYS (2048) OR RUN-STOP/RESTORE TO END
220 REM ** SYS (49166) TO RESUME **
230 SYS (49152)
240 NEW
```

Auto Number

Clifford Miller,
Orlando,
Florida,
U.S.A.

VIC-20

CBM-64

I FOUND GERALD DALY'S program in the November, 1983 issue of *Your Computer* for automatic line numbering on the Vic-20 very useful. However, I was unhappy to find that the program was designed for an unexpanded Vic. If it were to be run on a Vic-20 with memory expansion, all of the extra RAM would be lost.

I have modified Mr Daly's program to be used on a Vic-20 with any amount of memory expansion. The routine is stored at the top of RAM and the additional memory is preserved. The program runs exactly like Mr. Daly's except that the SYS commands to be used for the amount of RAM present are printed on the screen. Also since the start of Basic varies as the Vic-20 is expanded, it may be necessary to SYS to a location other than 4096 when interrupting the routine so that the system will not crash.

This same program will also run on the Commodore 64 with minor modifications. To enable automatic line numbering on the 64, type SYS(49152). It can be disabled by a SYS(2048) or by hitting Run-Stop/Restore. Resume with a SYS(49166)

To use either of these versions of Auto Number, load the program, type Run, and hit Return. To call a new line number, hit the space bar while the cursor is in the first column of a line, just as you would in the original program.

Function Keys

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SPECTRUM

THE SPECTRUM DOES NOT have a function key facility, and so I have written a machine-code program which allows any number of keys to be programmed very easily. This includes all the legends on the keys, the graphic symbols and the user-defined graphics, so that, for instance, the Print token can be programmed separately to the P and Tab. Of course, you will only wish to define keys you are unlikely to use for their normal

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purpose.

The definitions of keys should be put in separate Rem statements at the very beginning of the program. You should follow the line number and Rem by the symbol you wish to program, a colon, and then the definition. The definition can be any combination of characters, graphics and legends. If you want it to execute automatically then end it with the hash — # — character. If a syntax error is found when the line is executed, the line will be displayed at the bottom of the screen with a question mark as normal. Note that a key whose definition is just a hash, will act as an enter key.

The colon that must be put between the key to be defined and the definition not only conveniently separates the two but also puts the computer into K mode. If, however, you wish to start the definition with a letter of the alphabet which cannot be accessed in this mode, it is necessary to type any token or symbol that puts the computer into L mode, such as a keyword, then to type the character you want and finally to go back and delete whatever you used.

Rather than search through the whole program for key definitions, the program stops looking as soon as it finds the first proper program line. Therefore all the definitions must be put before the main program. This can be quite useful if you want a key which has been programmed to revert to its normal purpose temporarily.

Rather than deleting the definition all you need to do is change its line number so that it is, for instance, at the end of the program. Then at a later date you can change it back again. Lastly if a key is defined twice, it is the definition nearest the beginning of the program that will be taken. Note that a programmed key will repeat if held down.

The machine code is included in the data statements of the Basic program. The ninth figure of each statement is, however, the sum of the first eight and this is used by the program to check for errors in the data. Enter the Basic program, save it just to be on the safe side, and then run it. If an error is found the program will display the message Error In Line, followed by the line in which the error occurred. Note that the Basic program automatically alters the machine code if you have a 48K Spectrum, so that it is located at the top of memory — the actual data given is for the 16K model.

The program will then display Prepare To Save and the normal message will appear at the bottom of the screen. You may then save the machine code. After this it will print Prepare To Verify. Rewind the tape to the point where you started saving the code and the program will verify it automatically. If this is completed successfully, the Basic program will New itself leaving the machine code located at address 32348 for 16K machines or 65129 for 48K. In future, to load the machine-code, type

CLEAR 32347

for the 16K or

CLEAR 65128

for the 48K, followed by

LOAD "" CODE

The program must be turned on before it will work. This is done by:

"RANDOMIZE USR 32479' (16K)

or

"RANDOMIZE USR 65260" (48K)

To turn it off type:

"RANDOMIZE USR 32486" (16K)

or

"RANDOMIZE USR 65237" (48K)

Here are a few examples of key definitions

1 REM !: PAPER 7: INK 0: CLS: BORDER 7 #

2 REM .: PRINT 65536 – USR 7962#

3 REM NEW: INPUT A$: IF A$ = "Y" THEN NEW #

4 REM ■:

Rem 1 will reset all the colours — white paper and border, black ink — at a press of symbol shift – 1. This is useful if you are developing a program using a strange combination of colours. Often, after stopping such a program, the listing is almost unreadable.

Rem 2 will print out how much free memory you have left on typing a full-stop.

Rem 3 is a safeguard against Newing a program accidentally. On pressing New, you must input a string. If you enter Y the program will New. Anything else will mean that key press is ignored. Enter the New after the Rem by typing a colon, followed by the New then deleting the colon.

Finally Rem 4 allows you to type in quantities of data far quicker. It makes the space key act as a comma, avoiding the need for using the shift key.

```
  10 DATA 255,243,229,213,197,24
5,205,107,1694
  11 DATA 126,241,193,209,225,25
1,201,253,1699
  12 DATA 203,1,110,200,33,0,0,5
7,604
  13 DATA 235,237,123,61,92,225,
1,127,1101
  14 DATA 16,167,237,66,235,249,
192,42,1204
  15 DATA 83,92,24,2,235,9,35,35
,515
  16 DATA 78,35,70,35,84,93,126,
254,775
  17 DATA 234,192,35,58,8,92,190
,32,841
  18 DATA 235,35,126,254,58,32,2
29,35,1004
  19 DATA 126,254,13,40,223,11,1
1,11,689
  20 DATA 11,197,229,42,91,92,20
5,85,952
  21 DATA 22,19,237,83,91,92,35,
235,814
  22 DATA 225,193,237,176,235,43
,126,254,1489
  23 DATA 35,40,8,205,29,17,253,
203,790
  24 DATA 1,174,201,1,1,0,205,23
2,815
  25 DATA 25,62,13,50,8,92,253,2
03,706
  26 DATA 1,238,201,62,40,237,71
,237,1087
  27 DATA 94,201,62,62,237,71,23
7,86,1050
  28 DATA 201,0,0,0,0,0,0,0,201
 100 LET a=32348: IF PEEK 23732+
256*PEEK 23733>32767 THEN LET a=
65129
 105 PRINT "PLEASE WAIT"
 110 RESTORE : FOR f=0 TO 18: LE
T t=0: FOR g=0 TO 7
 120 READ d: POKE a+f*8+g,d: LET
t=t+d
 130 NEXT g: READ d: IF d<>t THE
N PRINT '"ERROR in line ";f+10:
STOP
 140 NEXT f
 150 IF a=65129 THEN POKE 65261,
9: POKE 65136,120: POKE 65137,25
4
 160 PRINT '"PREPARE TO SAVE 'Fu
nc keys'"
 170 SAVE "Func keys"CODE a,150
 180 PRINT '"PREPARE TO VERIFY '
Func keys'"
 190 VERIFY "Func keys"CODE a,15
0
 200 PRINT '"ON  : ";a+131'"OFF
: ";a+138
 210 PRINT '"Press any key to NE
W basic prog."
 220 PAUSE 0
 230 CLEAR a-1: NEW
```

Copy function

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ZX-81

USING THE COPY command on the ZX-81 is a simple and effective way of dumping the contents of the screen to the ZX Printer but it does have one drawback — it copies the whole of the screen even though the bottom half or more is blank.

The routine that I wrote to solve this problem is 51 bytes in length and, for a change, is slower than the equivalent Basic. It will also only work with a fully expanded display file.

If listing 1 is entered and Run it will list itself on the printer and the string prompts will appear. If the hex digits in listing 2 are now entered followed by the letter S the program will Poke the routine into the Rem statement at line 1 and then jump to line 200. Listing 2 will be displayed on the screen and copied from there to the printer by the routine.

If you study lines 330 to 380 you will see that the routine will only copy down to the line where the last "printing" has occurred.

If everything has been entered correctly you should finish up with listings 1 and 2 exactly as shown although those with economy in mind should omit lines 10, 20 and 30.

Listing 1

```
   1 REM 0000000000000000000000000
0000000000000000000000000000000000
000
  10 LPRINT "LISTING 1"
  20 LPRINT
  30 LLIST
  40 LET X=16514
  50 LET Q$=""
  60 IF Q$="" THEN INPUT Q$
  70 IF Q$="S" THEN GOTO 200
  80 POKE X,16*CODE Q$+CODE Q$(2
)-476
  90 IF PEEK 16442<=2 THEN SCROL
L
 100 PRINT X;" ";Q$(TO 2)
 110 LET Q$=Q$(3 TO )
 120 LET X=X+1
 130 GO TO 60
 200 CLS
 210 FOR N=16514 TO 16564 STEP 8
 220 PRINT N;":";
 230 FOR O=0 TO 7
 240 LET Q=PEEK (N+O)
 250 LET H=INT (Q/16)
 260 LET L=Q-16*H
 270 LET Q$=CHR$ (H+28)+CHR$ (L+
28)
 280 PRINT " ";Q$;
```

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COMMODORE 64

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(continued from page 188)

```
290 IF N+O=16564 THEN GOTO 330
300 NEXT O
310 PRINT
320 NEXT N
330 LPRINT
340 LPRINT "LISTING 2"
350 LPRINT
360 RAND USR 16514
370 LPRINT
380 LPRINT "PROGRAMME FINISHED"
390 STOP
```

Listing 2

```
16514: 2A 0E 40 ED 5B 0C 40 2B
16522: A7 ED 52 C0 11 21 00 05
16530: 01 ED B2 28 04 04 30 F9
16538: 05 2A 0C 40 FD CB 01 CE
16546: E5 23 7E D7 3E 75 3C BE
16554: 20 F7 E1 19 10 F2 FD C5
16562: 01 0E C9
```

Transform

W Lythgoe,
Shevington,
Wigan.

SPECTRUM

THIS PROGRAM TRANSFORMS drawings up to 50 by 50 pixels in size when they are expressed in Plot and Draw statements. Two examples are given and then you can Input your own drawing.

First draw the diagram on 50 by 50 graph paper and write it out in Plot and Draw statements. Count the number of Draw statements and Enter this. The Enter the co-ordinates as required.

To add your drawing to the data statements change line 110 to:

For m = 1 TO 4

and add a new data line, following the Rem instructions in line 4990.

Further data lines can be added, increasing the final number in line 110 by 1 for each diagram.

```
  10 REM transform
  20 REM W. Lythgoe
 110 FOR m=1 TO 3
 120 IF m<>3 THEN GO SUB 500
 130 IF m=3 THEN GO SUB 1000
 135 DIM c(j+1): DIM d(j+1)
 140 FOR n=1 TO 33
 175 FOR i=1 TO j+1
 180 LET c(i)=0: LET d(i)=0
 185 NEXT i
 187 INK RND*4
 188 GO SUB 2000+10*n
 190 FOR i=1 TO j+1
 200 IF i=1 THEN PLOT a+x(i)*p,b
+y(i)*q
 210 IF i>1 THEN DRAW c(i)+x(i)*
p,c(i)+y(i)*q
 220 NEXT i
 250 BEEP .5,n-12
 255 CLS
 260 NEXT n
 270 NEXT m
 280 STOP
 500 READ j
 510 DIM x(j+1)
 520 DIM y(j+1)
 530 FOR i=1 TO j+1
 540 READ x(i): READ y(i)
 550 NEXT i
 560 RETURN
1000 INPUT "How many DRAWs?";j
1010 DIM x(j+1)
1020 DIM y(j+1)
1030 FOR i=1 TO j+1
1040 IF i=1 THEN INPUT "PLOT x c
o-ord?";x(i): INPUT "PLOT y co-o
rd?";y(i)
1050 IF i>1 THEN INPUT "DRAW x c
o-ord?";x(i): INPUT "DRAW y co-o
rd?";y(i)
1060 NEXT i
1070 RETURN
2010 PRINT "TRANSLATIONS": PAUSE
 200: LET a=0: LET b=0: LET p=1:
 LET q=1:
2015 RETURN
2020 LET a=50: RETURN
2030 LET a=0: LET b=50: RETURN
2040 LET a=50: RETURN
2050 LET a=100: LET b=0: RETURN
2060 LET b=100: RETURN
2070 LET a=0: RETURN
2080 PRINT "REFLECTIONS": PAUSE
200: LET b=0: RETURN
2090 LET a=100: LET p=-1: RETURN
2100 LET p=1: RETURN
2110 LET a=100: LET b=100: LET q
=-1: RETURN
2120 LET q=1: RETURN
2130 LET p=-1: RETURN
2140 LET a=0: LET p=1: RETURN
2150 LET q=-1: RETURN
2160 PRINT "ROTATIONS THROUGH 90
 DEGREES": PAUSE 200: LET q=1: L
ET b=0: RETURN
2170 LET p=-1: LET q=1: GO SUB 3
000: LET a=a+50: RETURN
2180 LET q=-1: LET a=50: LET b=5
0: RETURN
2190 LET p=1: GO SUB 3000: LET b
=b+50: RETURN
2200 PRINT "ENLARGEMENTS": PAUSE
 200: LET a=0: LET b=0: LET p=1:
 LET q=1: RETURN
2210 LET p=2: RETURN
2220 LET p=3: RETURN
2230 LET p=1: LET q=2: RETURN
2240 LET q=3: RETURN
2250 LET p=2: LET q=2: RETURN
2260 LET p=3: LET q=3: RETURN
2270 PRINT "DISTORTIONS": PAUSE
200: LET a=0: LET b=0: LET p=1:
LET q=1: RETURN
2280 GO SUB 3100: RETURN
2290 LET q=2: GO SUB 3100: RETUR
N
2300 LET q=3: GO SUB 3100: RETUR
N
2310 LET p=2: GO SUB 3100: RETUR
N
2320 LET p=3: GO SUB 3100: RETUR
N
2330 LET p=1: LET q=1: RETURN
3000 FOR i=1 TO j+1
3005 LET a=p*(y(1)-x(1))
3010 LET c(i)=p*(y(i)-x(i))
3015 LET b=q*(x(1)-y(1))
3020 LET d(i)=c*(x(i)-y(i))
3030 NEXT i
3040 RETURN
3100 FOR i=1 TO j+1
3110 LET c(i)=p*.5*(y(i)-x(i))
3120 NEXT i
3130 RETURN
4990 REM First no. in each DATA
line is no. of DRAWs. 2nd and
3rd nos. are PLOT co-ords.
Subsequent nos. are DRAW co-ords
5000 DATA 3,0,0,50,0,0,50,-50,-5
0
5010 DATA 32,15,0,5,1,2,1,9,0,5,
2,4,4,0,6,-2,3,-3,0,2,-7,-5,-5,-
7,-2,5,4,1,5,-1,6,-3,5,-3,4,2,3,
0,5,-2,3,-2,10,-4,-10,-2,0,-3,10
,-3,-10,-2,-5,0,-4,2,-3,-4,-7,-1
,-9,1,-6,5,-3,6,-1
```

Character definer

Mazen Kisawi,
North Ahmadi,
Kuwait.

ZX-81

THIS PROGRAM enables ZX-81 users to define their own characters, using a ZX Printer. Before entering the program type New and

POKE 16389,124

Now type in the program and run it.

In the top left-hand corner of the screen line 1 will be reprinted, and the program then waits for an input. The character will be defined on an eight-by-eight grid.

Whenever you want a dot on the first line, enter a full stop. Whenever you want a blank, input a space. This continues for eight lines, working horizontally.

After the character has been defined you can either move on to another character or type in Plot. After that there will be a short pause before the character is printed on the printer. To save any character use the string-saving method. A character is defined between B$ (1) and B$ (8). ■

```
   1 IF PEEK 16388+256*PEEK 1638
9=31744 THEN GOTO 5
   2 POKE 16384,21
   5 FOR I=0 TO 112
   6 POKE 31744+I,PEEK (2161+I)
   7 NEXT I
   8 POKE 31800,63
   9 POKE 31857,201
  12 DIM A$(32,9)
  15 FOR N=1 TO 32
  20 FOR A=1 TO 8
  25 LET C=0
  30 PRINT AT 0,0;"LINE ";A
  40 INPUT B$
  41 PRINT AT A+1,0;B$
  42 IF B$="PLOT" THEN GOTO 9988
  43 IF LEN B$<8 THEN LET B$=B$+
"
  44 IF B$( TO 4)="EXIT" THEN PO
KE 16384,13
  50 IF B$(1)="." THEN LET C=C+2
**7
  60 IF B$(2)="." THEN LET C=C+2
**6
  70 IF B$(3)="." THEN LET C=C+2
**5
  80 IF B$(4)="." THEN LET C=C+2
**4
  90 IF B$(5)="." THEN LET C=C+2
**3
 100 IF B$(6)="." THEN LET C=C+2
**2
 110 IF B$(7)="." THEN LET C=C+2
 120 IF B$(8)="." THEN LET C=C+1
 130 LET A$(N,A+1)=CHR$ C
 135 PRINT AT 21,0;C
 140 NEXT A
 145 CLS
 150 NEXT N
9990 FOR J=1 TO 32
9991 FOR K=1 TO 8
9992 POKE 32255+K+8*(J-1),CODE A
$(J,K+1)
9993 NEXT K
9994 NEXT J
9995 FOR H=0 TO 31
9996 POKE 16444+H,H
9997 NEXT H
9998 LET HPRINT=USR 31744
9999 POKE 16384,28
```

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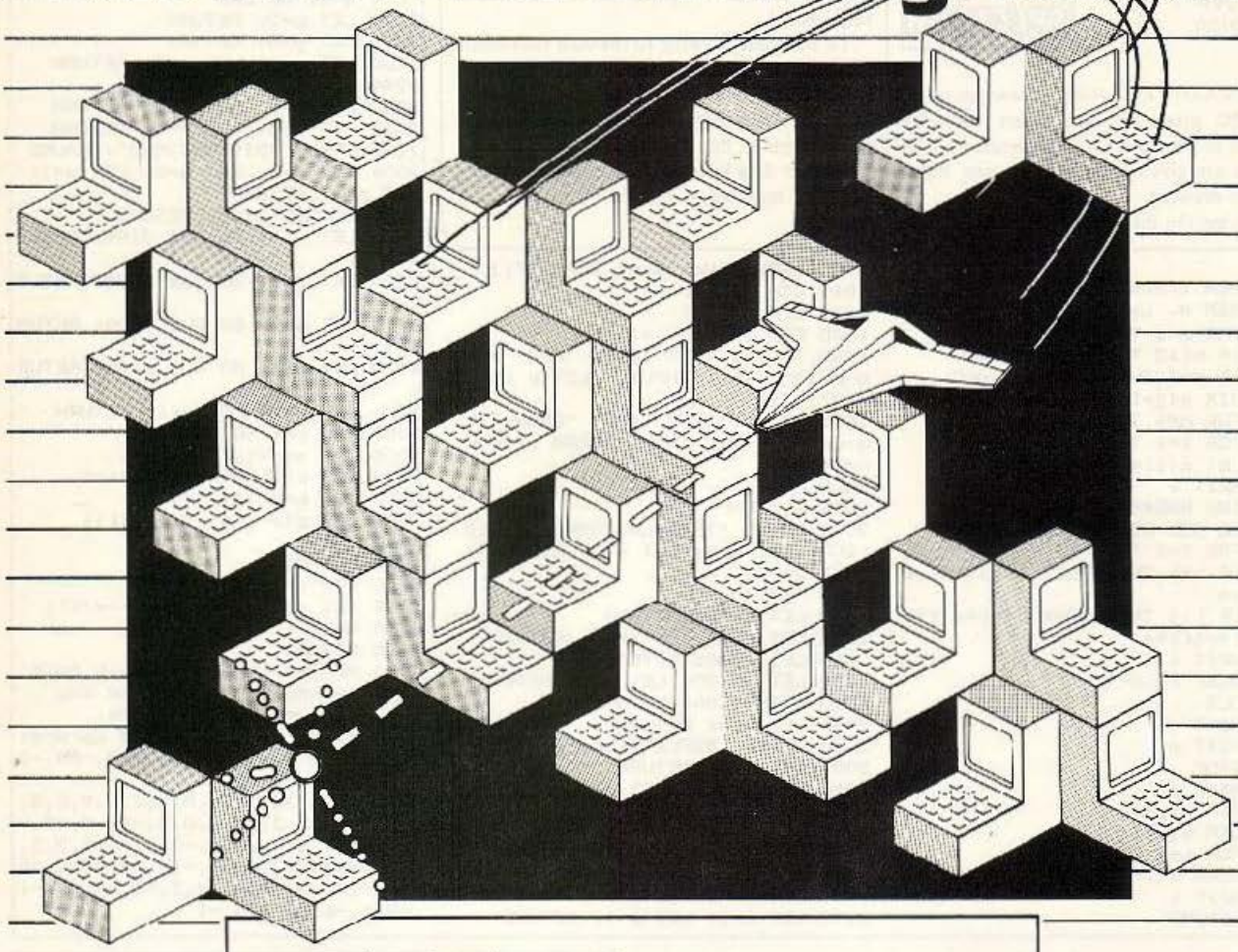

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MEMOTECH competition RESULTS

UNLIKE MOST of our competitions, February's contained an extremely tough puzzle. It succeeded in weeding out all but a handful of entries — six to be precise.

The problem was that if you started out by assuming that all six black bricks may be salvaged you were bound to fail. There are 2,900,000 permutations of movement order and direction on this assumption and none of them work.

In fact the maximum number of bricks you can set free is four. And the minimum number of bricks you can destroy on the way is 36, including two black bricks. The correct order of movement and direction is as follows:

1. Brick 6 to the south-east
2. Brick 4 to the north-west
3. Brick 3 to the north-east
4. Brick 2 to the north-west
5. Brick 1 to the south-east

It does not matter how the brick with five dots moves since brick 6 collides with it. Both are consequently destroyed.

Two of the six correct entries mentioned that they had used a computer to solve the puzzle. If the others did not rely on a program solution they must have been blessed with either luck or inspiration.

A. Llevellyn-Jones, 2A Elmbridge Road, Gloucester, GL2 0NZ programmed a Spectrum to crack the puzzle. It ran for 10 hours before coming up with the solution. He complains that this marathon created all sorts of thermal stresses and strains to the machine and himself.

He should be mollified to learn that his tie-breaker wins him the prize of a Memotech MTX 500. The opening sentence read "At work and at play a Memotech would make my day". He completed it by adding "with memory galore, sixteen colours and more, what a splendid give away".

The other program solution came from Yugoslavia. Jovan Puzovic also used a Spectrum which again took 10 hours over it. His tie-breaker read simply, "joyful and gay".

Most contenders struck a similar poetic note. From D. Stanford came "with many problems soon made light by solving puzzles through the night"; A. Gram suggested "its styling is striking, its memory inviting, please I want one today", and K. Cross offered "it's the best, it's clear every day of the year".

Others deserving of a mention were J. Middleton's "with features unique and design so sleek" and R. Pendall's "for accounting or counting, it's money well spent".

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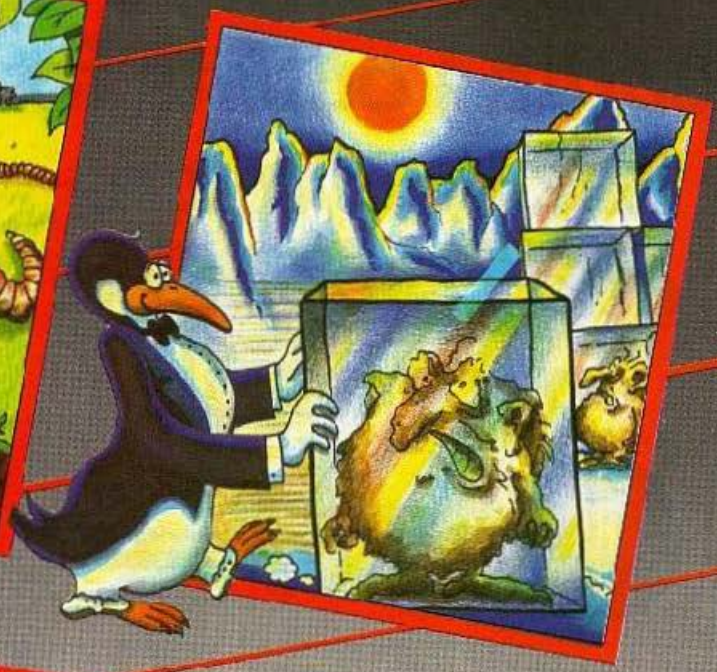

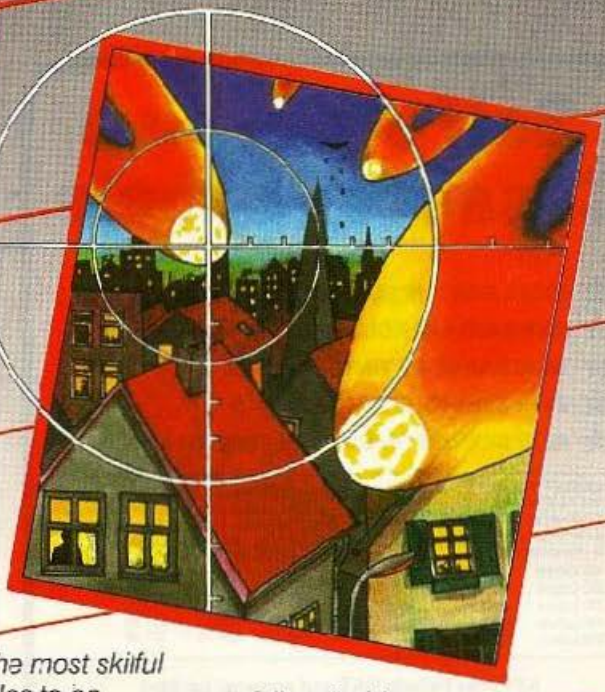

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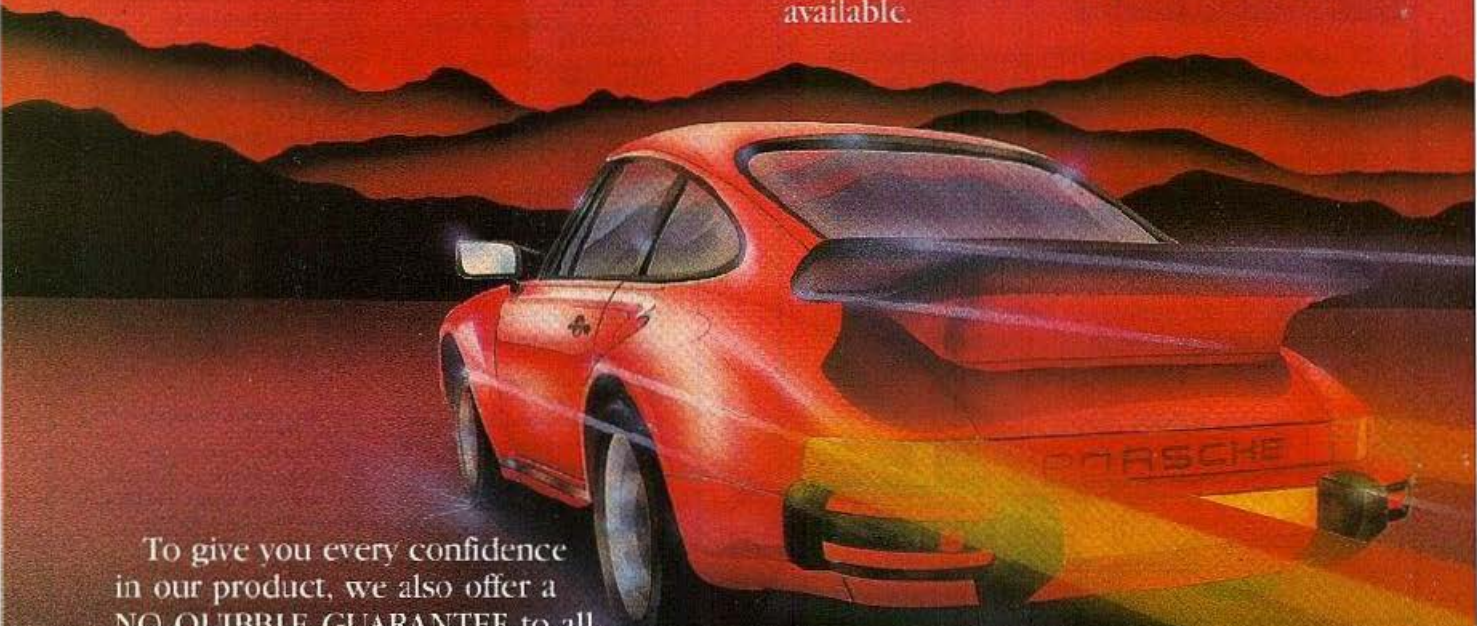

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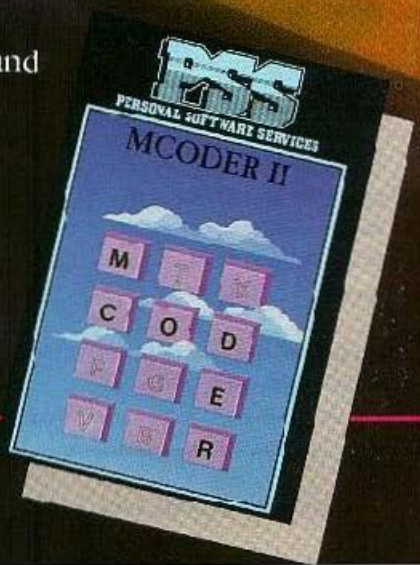

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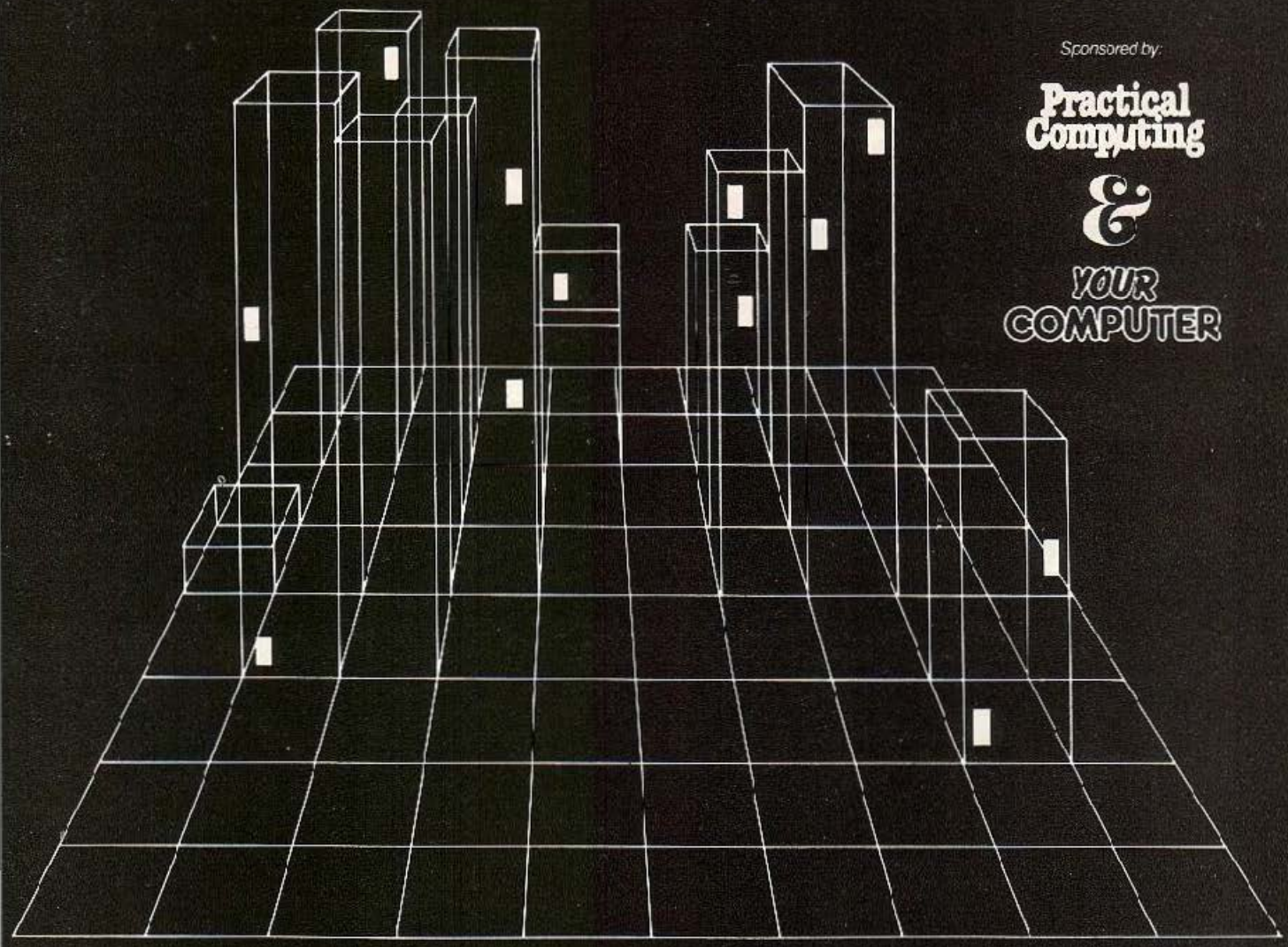

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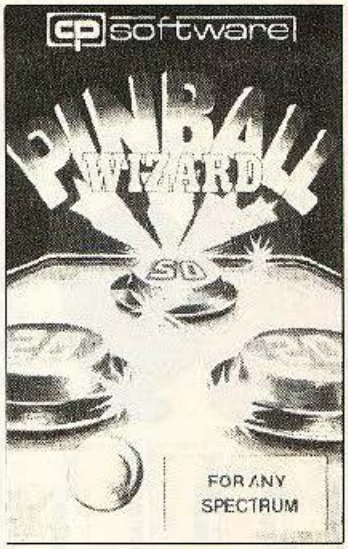

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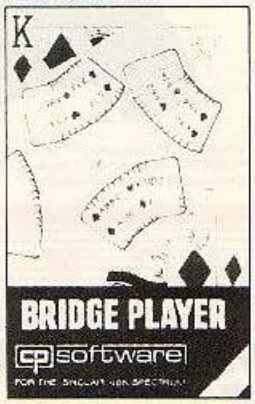

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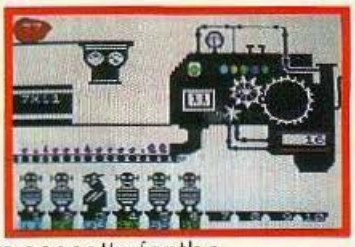

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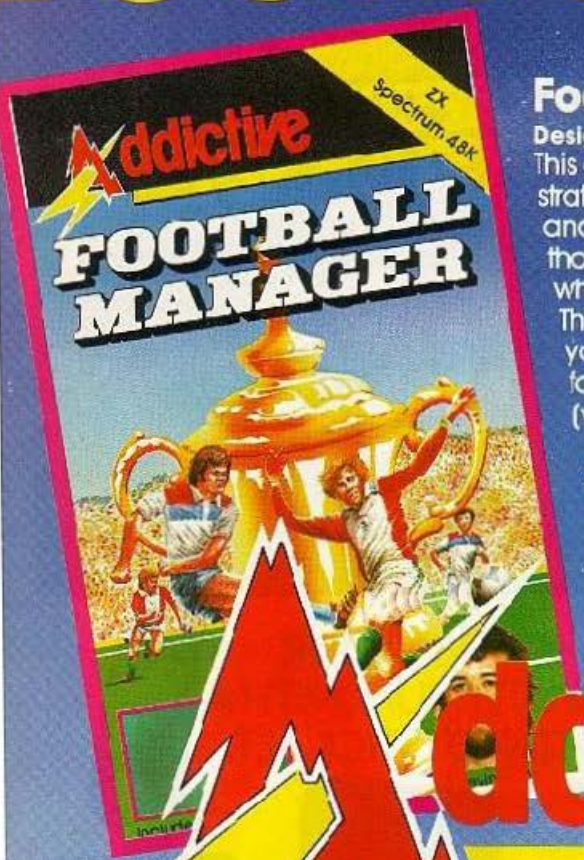

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*ZX81 Chart, Home Computing Weekly 16.8.83

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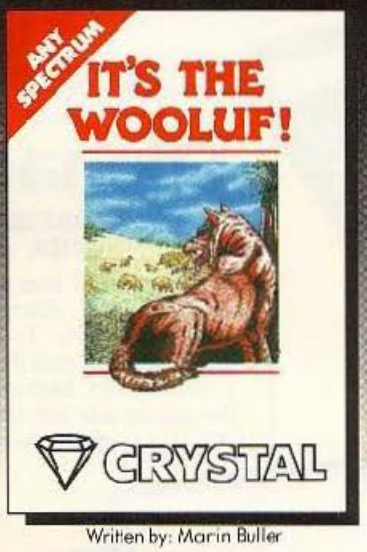

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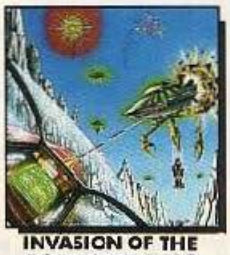

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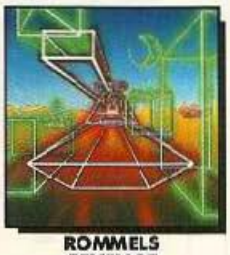

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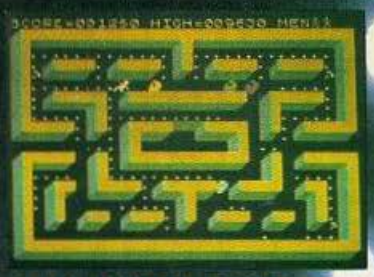

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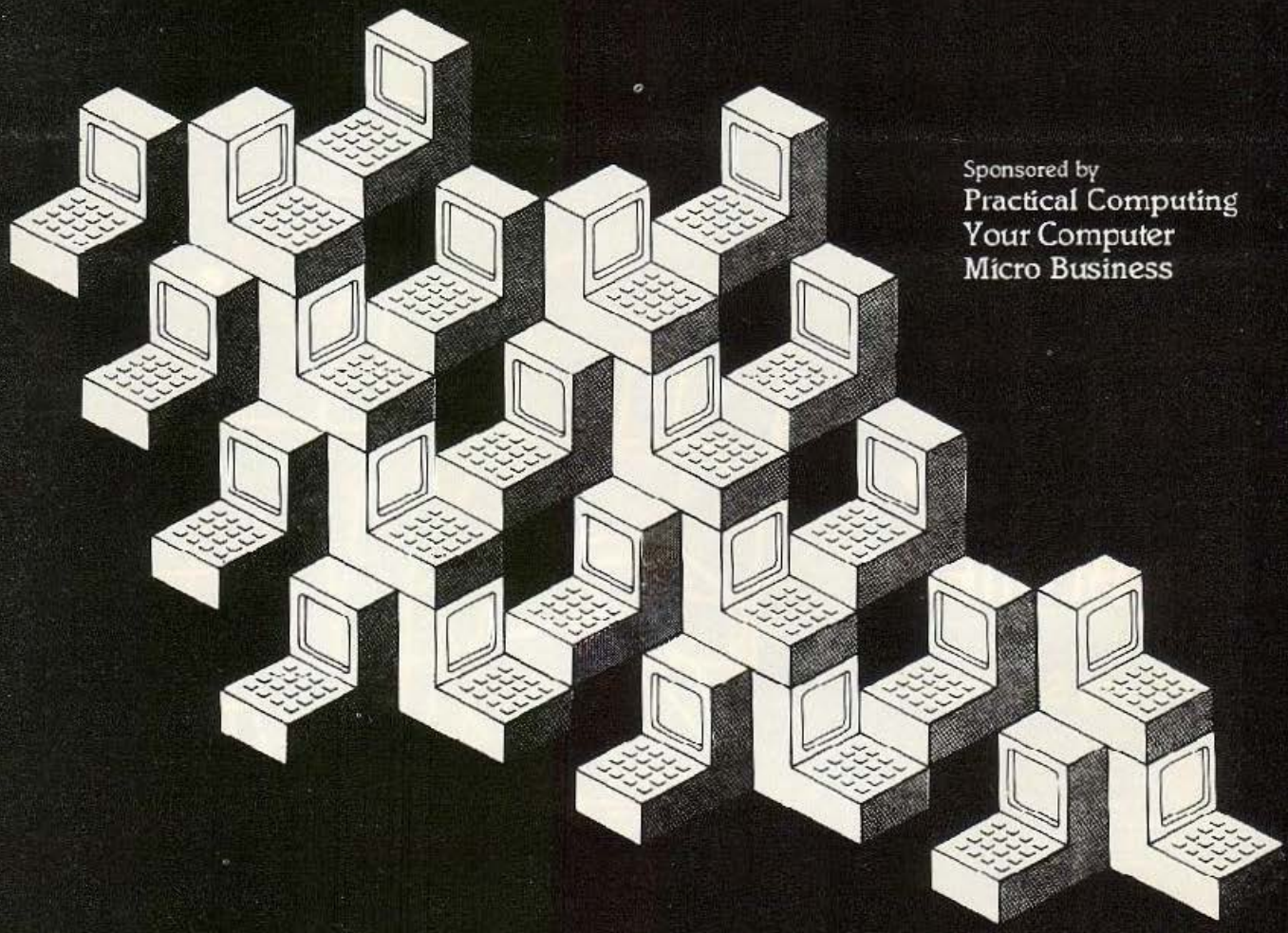

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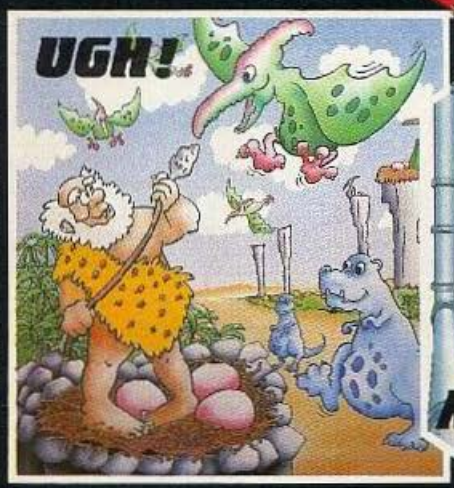

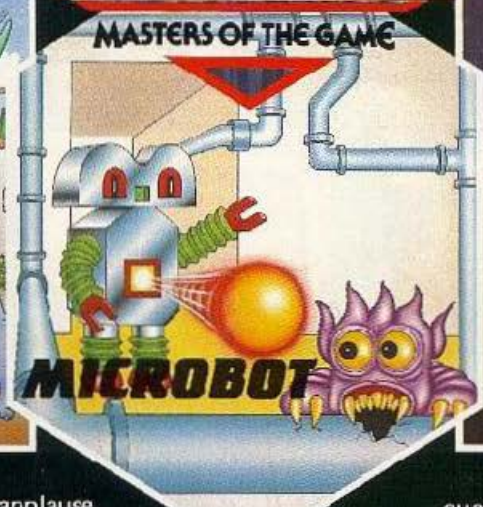

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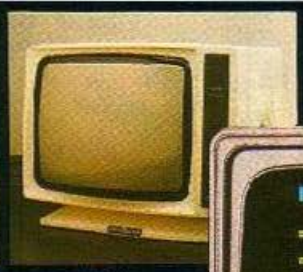

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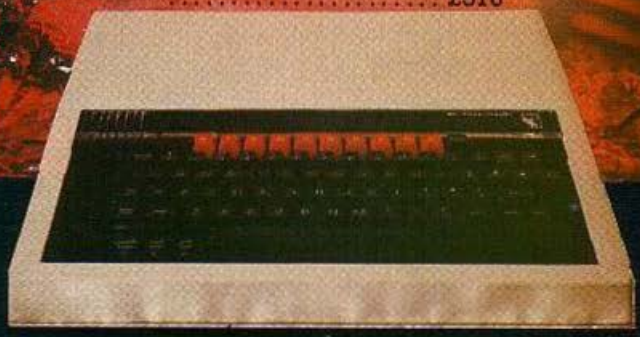

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** Which Micro Hardware Revue – Spectravideo SV-318 *® CP/M is a registered trade mark of Digital Research Inc.

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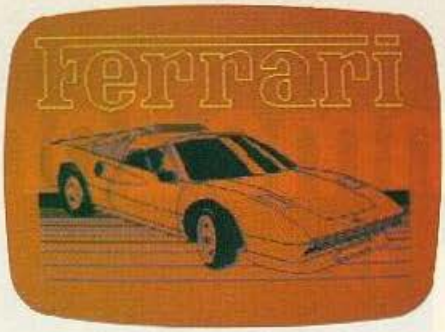

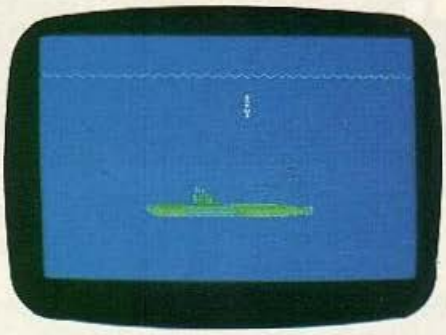

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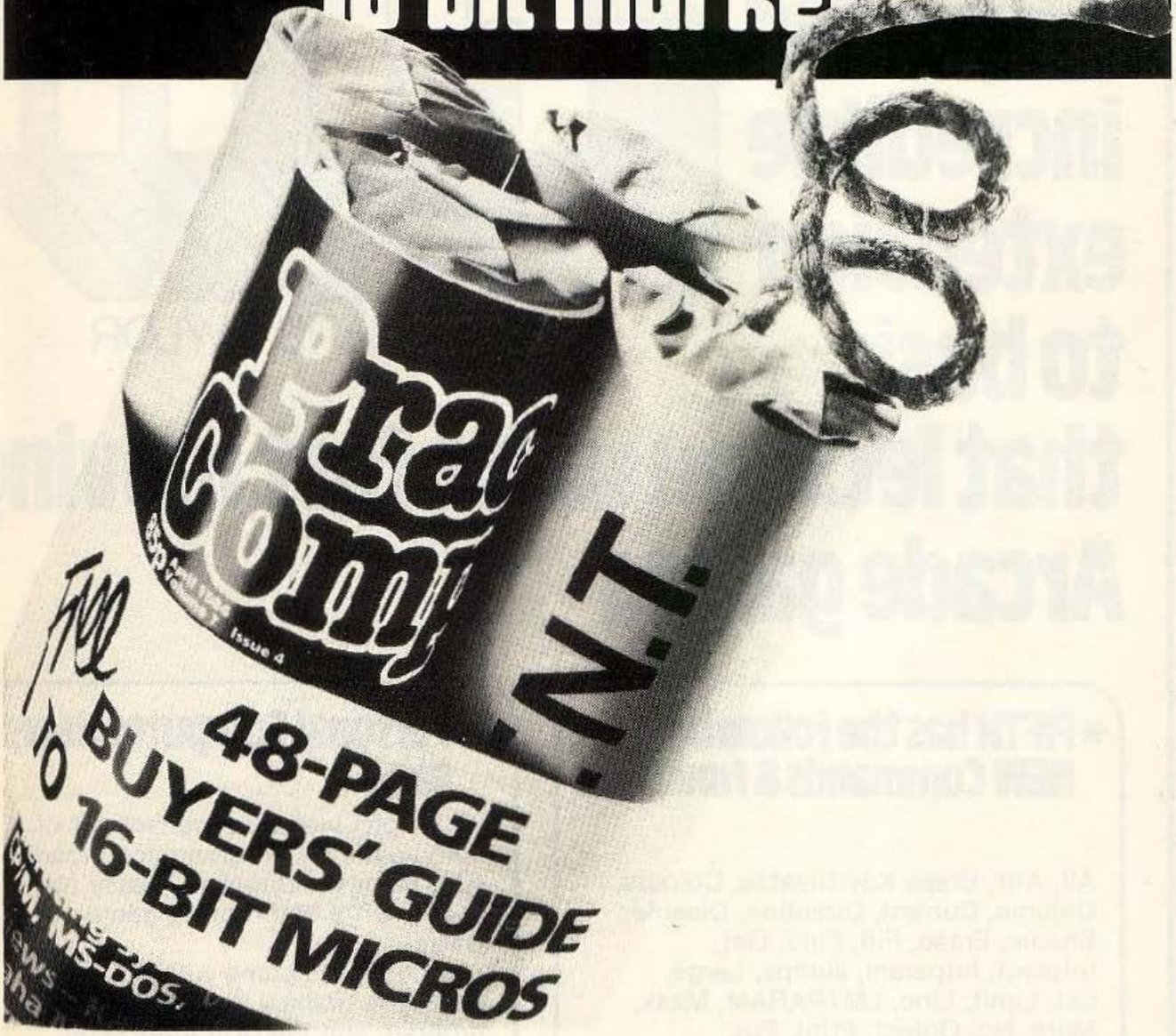
This month's Practical Computing guides you through the exploding 16 bit market



With April's issue of Practical Computing we've got the most detailed guide yet to 16 bit micros. Our free 48 page supplement covers over 80 machines.

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THE REVOLUTION IS HERE

FIFTH

A new and incredible extension to basic that lets you write fast moving Arcade games

BY RICHARD TAYLOR

*FIFTH has the following NEW Commands & functions

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*Personal Computer News said:

"Fifth provides an excellent set of commands for programming arcade type games and makes it easy for you to write fast moving games in Basic."

The packages come with an extensive manual, a demonstration program and the fifth interpreter. The commands are entered as words into your program and give you INTERRUPT, driven, fast, high resolution SPRITE graphics without losing the simplicity of Basic.

Buy FIFTH and get a City Bomber FREE!

Just TYPE in this program by Richard Taylor with your Fifth Interpreter.

```
  2 REM *          BOMBER          *
  3 REM *  By RICHARD TAYLOR       *
  4 REM * © CRL September '83      *
  5 REM ***********************
  6 REM
 10 RANDOMIZE 1000
 20 RANDOMIZE USR 61030
 30 RANDOMIZE : BORDER 5
 40 OVER 0: INVERSE 0: FLASH 0
 50 BRIGHT 0: INK 3: PAPER 7
 60 CLS
 70 GO SUB 9000
 80 GO SUB 3000
 90 LET Hi=0: LET z=1: LET Scor
e=0
 100 CLS : PRINT "  HI:";Hi;TAB
20;"SCORE:";Score
 110 PLOT 0,163: DRAW 255,0
 120 LET a=4000: REM LIMIT a
 130 LET b=6000: REM INTERACT a
 140 GO SUB 3000
 150 LET x=0: LET y=50: REM MOVE
 Plane,x,y
 160 LET k=255: LET a=30: REM MO
VE Enemy,x,a
 170 GO SUB 2000: GO TO 170
1000 LET a=0: LET b=176
1010 REM MOVE Plane,d,b\ENABLE P
lane
1020 REM ALL Bomb\MOVE Bomb,a,b
1030 REM ENABLE Bomb
1040 REM MOVE Enemy,a,b\ENABLE E
nemy
1050 CLS
1060 FOR a=0 TO 7
1070 PRINT PAPER a;: REM FILL
1080 BEEP .1,a*5: NEXT a
1090 PAUSE 25: FOR a=60 TO 0 STE
P -1: BEEP .005,a: NEXT a
1100 FOR c=2 TO 1000 STEP 20
1110 LET a=10: LET b=0: LET d=50
1120 REM SOUND a,b,c,d
1130 NEXT c
1140 LET a$="SCORE:"+STR$ Score
1150 LET x=0: LET y=50: LET t=2:
 LET w=3
1160 REM TEMPS\LARGE
1170 IF Hi>Score THEN GO TO 1200
1180 LET Hi=Score: LET a$="A New
 HIGH SCORE"
1190 LET x=60: LET y=100: LET t=
2: LET w=1: PRINT INK 1;: REM LA
RGE
1200 PRINT #0; FLASH 1;"          A
 New Level? [y/n]
1210 IF INKEY$<>"" THEN GO TO 12
10
1220 IF INKEY$="n" OR INKEY$="N"
 THEN GO TO 1500
1230 IF INKEY$<>"y" AND INKEY$<>
"Y" THEN GO TO 1220
1240 INPUT "New Level? ";Level
1250 IF Level<0 OR Level>3 OR Le
vel<>INT Level THEN GO TO 1240
1260 GO TO 90
1500 INPUT INKEY$: PRINT #0; FLA
SH 1;"          Another Game? [y/n]
 "
1510 IF INKEY$<>"" THEN GO TO 15
10
1520 IF INKEY$="y" OR INKEY$="Y"
 THEN LET Score=0: LET z=1: GO T
O 100
1530 IF INKEY$<>"n" AND INKEY$<>
"N" THEN GO TO 1520
1540 LET a$="OK": LET w=16: LET
t=22
1550 CLS
1560 LET x=0: LET y=0: REM TEMPS
\LARGE
1570 LET a=21: LET b=31: REM GET
x,y,a,b,a$
1580 FOR a=0 TO 21: LET b=a*.687
5
1590 REM PUT a,b,a$
1600 PAUSE 5: NEXT a
1610 LET a=INT (RND*8): PAPER a:
 BORDER a: CLS : BEEP 1,-10
1620 GO TO 1610
2000 LET a$=INKEY$: IF a$="" THE
N RETURN
2010 IF a$="G" THEN LET y=y+1+(L
evel/2): LET Score=Score-2
2020 IF a$="7" THEN LET y=y-1-(L
evel/2): LET Score=Score-10
2025 PRINT AT 0,26;Score;"  "
2030 IF y<20 THEN LET y=20
2032 IF y>160 THEN LET y=160
2035 REM MOVE Plane,COLUMN Plane
,y
2040 IF a$<>"0" THEN RETURN
2050 REM USE Bomb,z
2060 LET z=z+1: IF z=4 THEN LET
z=1
2070 REM LET a=LINE Plane\LET b=
COLUMN Plane\LET c=LINE Bomb
2075 IF c<>176 THEN RETURN
2080 LET a=a+10: LET c=(INT ((c+
4)/8))-32*(c>250)  REM MOVE Bomb
,b,a
2090 RETURN
3000 FOR a=2 TO 31: LET b=INT (R
ND*10)+1: IF RND>.8 THEN GO TO 3
040
3010 LET d=INT (RND*5): FOR c=21
TO 21,b STEP -1
3020 PRINT AT c,a, INK d; BRIGHT
 RND;"▟": BEEP .005,c+25: NEXT c
3030 PRINT AT c,a, INK d;"▟"
3040 NEXT a: RETURN
4000 REM LMTPARAM
4010 IF h$="plane" THEN GO TO 50
00
4015 IF h$="enemy" THEN GO TO 45
00
4020 LET n=176: REM LET p=CURREN
T h$\USE h$,h\MOVE h$,COLUMN h$,
o\ENABLE h$\USE h$,p
4030 CONTINUE
4500 REM LET o=LINE enemy
4510 LET n=n+11+INT (RND*8)  IF
o>=150 THEN LET o=150
4520 IF o<20 THEN LET o=20
4530 LET p=255: REM MOVE enemy,p
,o\ENABLE enemy
4540 CONTINUE
5000 REM LET y=LINE Plane
5010 LET p=0  LET y=y+4: IF y>=1
68 THEN GO TO 5500
5020 REM MOVE Plane,p,y\ENABLE P
lane
5030 LET Score=Score-1: PRINT AT
 0,26;Score;"  "
5040 BEEP .005,60  CONTINUE
5500 LET a=176: LET b=0: REM MOV
E Plane,b,a\ENABLE Plane
5510 REM MOVE Enemy,b,a\ENABLE E
nemy
5520 REM ALL Bomb\MOVE Bomb,b,a\
ENABLE Bomb
5530 POKE 23681,0  CLS
5540 LET a$="YOU HAVE LANDED"
5550 LET w=2  LET t=1: LET x=0:
LET y=0
5560 PRINT INK 2;  REM LARGE
5570 LET Score=Score+200
5580 GO TO 1000
6000 REM INTPARAM
6010 IF h$="bomb" OR i$="bomb" T
HEN GO TO 7000
6020 IF h$="plane" OR i$="plane"
 THEN POKE 23681,0: GO TO 1000
6030 LET p=255: LET o=50: REM MO
VE enemy,p,o\ENABLE enemy
6040 CONTINUE
7000 IF h$="enemy" OR i$="enemy"
 THEN GO TO 7500
7005 IF i$="bomb" THEN LET h=i
7010 LET o=176: REM LET p=CURREN
T Bomb\USE Bomb,h\LET q=LINE Bom
b\LET r=COLUMN Bomb\MOVE Bomb,CO
LUMN Bomb,o\ENABLE Bomb\USE Bomb
,p
7020 LET q=INT (q/8): LET r=INT
(r/8): IF r>31 THEN LET r=31
7025 IF q>21 THEN LET q=21
7030 LET p=q+INT (RND*5)+1: IF p
>21 THEN LET p=21
7035 FOR o=q TO 18 STEP -1: PRIN
T AT o,r-1+(r=0);"  ";AT o,r  "
";
AT o,r+1 (r=31);"  ": BEEP .01,o+
20: NEXT o
7040 FOR o=q TO p: PRINT AT o,r-
1+(r=0);"  ";AT o,r;"  ";AT o,r+1-
(r=31);"  ": BEEP .01,o+30: NEXT
o
7070 LET Score=Score+8-(Level*2)
: PRINT AT 0,26;Score;"  "
7080 CONTINUE
7500 LET o=50: REM MOVE Enemy,CO
LUMN Enemy,o\ENABLE Enemy
7510 IF h$="bomb" THEN LET i=h
7520 REM LET p=CURRENT Bomb\USE
Bomb,i\MOVE Bomb,COLUMN Bomb,o\E
NABLE Bomb\USE Bomb,p
7530 CONTINUE
8000 LET a$="BOMBER": LET x=8
8010 LET y=0: LET t=2: LET w=5
8020 PRINT PAPER 5; BRIGHT 1;"
3030 REM LARGE
3040 PLOT 3,160: DRAW 255,0
3050 LET a$="  A Game Using"
3060 LET x=0: LET y=25
3070 LET t=1: LET w=2
3080 REM TEMPS\LARGE
3090 PLOT 3,0: DRAW 255,0
3100 DRAW 3,175: DRAW -255,0
3110 DRAW 3,-175: LET t=3
3120 LET w=6: LET x=3
3130 LET y=35: LET a$="FIFTH"
3140 PRINT INK 2;: REM LARGE
3150 LET t=2: LET w=1
3160 LET x=55: LET y=65
3170 LET a$="By RICHARD TAYLOR"
3180 PRINT INK 1;: REM LARGE
3190 PRINT AT 12,5;"Key 6 to mov
e down"
3200 PRINT AT 14,5;"Key 7 to mov
e up"
3210 PRINT AT 15,5;"Key 0 to dro
p a bomb"
3220 PRINT AT 18,3;"  You must c
lear a path to";AT 19,3;"land on
."
3230 LET a=3: REM OBJECT Bomb,a
3240 LET a=1: REM OBJECT Plane,a
3250 REM OBJECT Enemy,a
3260 REM PRINT Bomb,a
3270 REM PRINT Plane,a\PRINT Ene
my,a
3280 LET a=1: LET d=2: LET b=3:
LET c=6
3290 REM SPEED Bomb,b,c
3300 REM SPEED Plane,d,a
3310 REM SPEED Enemy,d,a
3320 PRINT INK 3;: REM COLOUR Bo
mb
3330 PRINT INK 1;: REM COLOUR En
emy
3340 LET a=7: REM VECTOR Bomb,a
3350 LET a=4: REM VECTOR Plane,a
3360 LET a=12: REM VECTOR Enemy,
a
3370 FOR c=3 TO 13 STEP 10
3380 FOR a=0 TO 500 STEP 10
3390 LET b=5: LET d=30
3400 REM SOUND b,c,d,a
3410 NEXT a: NEXT c
3420 PAUSE 100
3430 BEEP .2,-12: BEEP .2,-10: B
EEP .2,-8: BEEP .2,-12: BEEP .2,
-12: BEEP .2,-10: BEEP .2,-8: BE
EP .2,-7: BEEP .2,-5: BEEP .2,-5
: BEEP .2,-8: BEEP .2,-7: BEEP .
2,-5: BEEP .3,-5
3440 PAUSE 50
3450 FOR a=0 TO 7: PAPER a
3460 INK 9: PRINT PAPER a-1+8*(a
=0); INK 8;: REM REPLACE
3470 LET b=40: LET c=5: LET d=8:
LET e=90
3480 REM SOUND b,c,d,e
3490 NEXT a: PAPER 7: INK 0
3500 LET a$="  Press any key to
continue  "
3510 PRINT #0;AT 1,0; BRIGHT 1;a
$
3520 PAUSE 5: LET a$=a$(2 TO )+a
$(1)
3530 IF INKEY$="" THEN GO TO 351
0
3540 CLS
3550 PRINT AT 17,0; FLASH 1; BRI
GHT 1;"SELECT LEVEL:"
3560 PRINT "0 - Easy"
3570 PRINT "1 - Medium"
3580 PRINT "2 - Hard"
3590 PRINT "3 - Very Hard"
3600 INPUT "Please Select:";Leve
l
3610 IF Level<0 OR Level>3 OR Le
vel<>INT Level THEN GO TO 3600
3615 REM ERASE Plane
3620 RETURN
9000 RESTORE
9010 FOR a=USR "a" TO USR "a"+47
9020 READ b: POKE a,b: NEXT a
9030 RETURN
9040 DATA 0,0,0,0,56,124,124,56
9050 DATA 255,153,153,255,255,15
3,153,255
9060 DATA 24,60,126,255,255,153,
153,255
9070 DATA 0,152,145,159,223,153,
153,255
9080 DATA 0,6,249,55,255,255,16,
0
9090 DATA 0,0,159,195,255,255,4,
0
9500 SAVE "Bomber" LINE 9990: SA
VE "Data"CODE 61030,4358
9990 CLEAR 61029: LOAD ""CODE
9999 RUN
```

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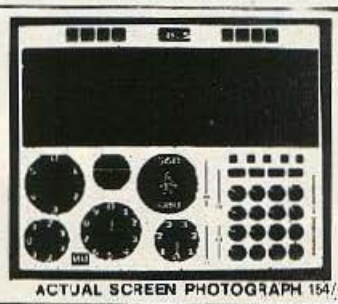

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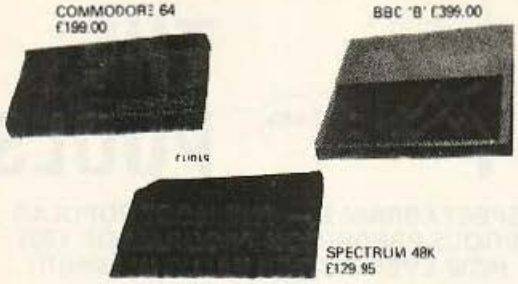

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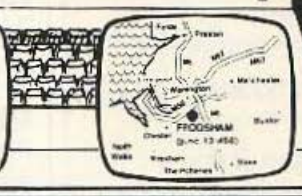

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Karen Page (left) and Marguerite Ryan link arms to hold back the micro crazed hordes eager to rush into Steiger, claimed to be the world's largest computer store. The 25,000 square foot showroom at Stonebridge Park, north-west London is the first of many.

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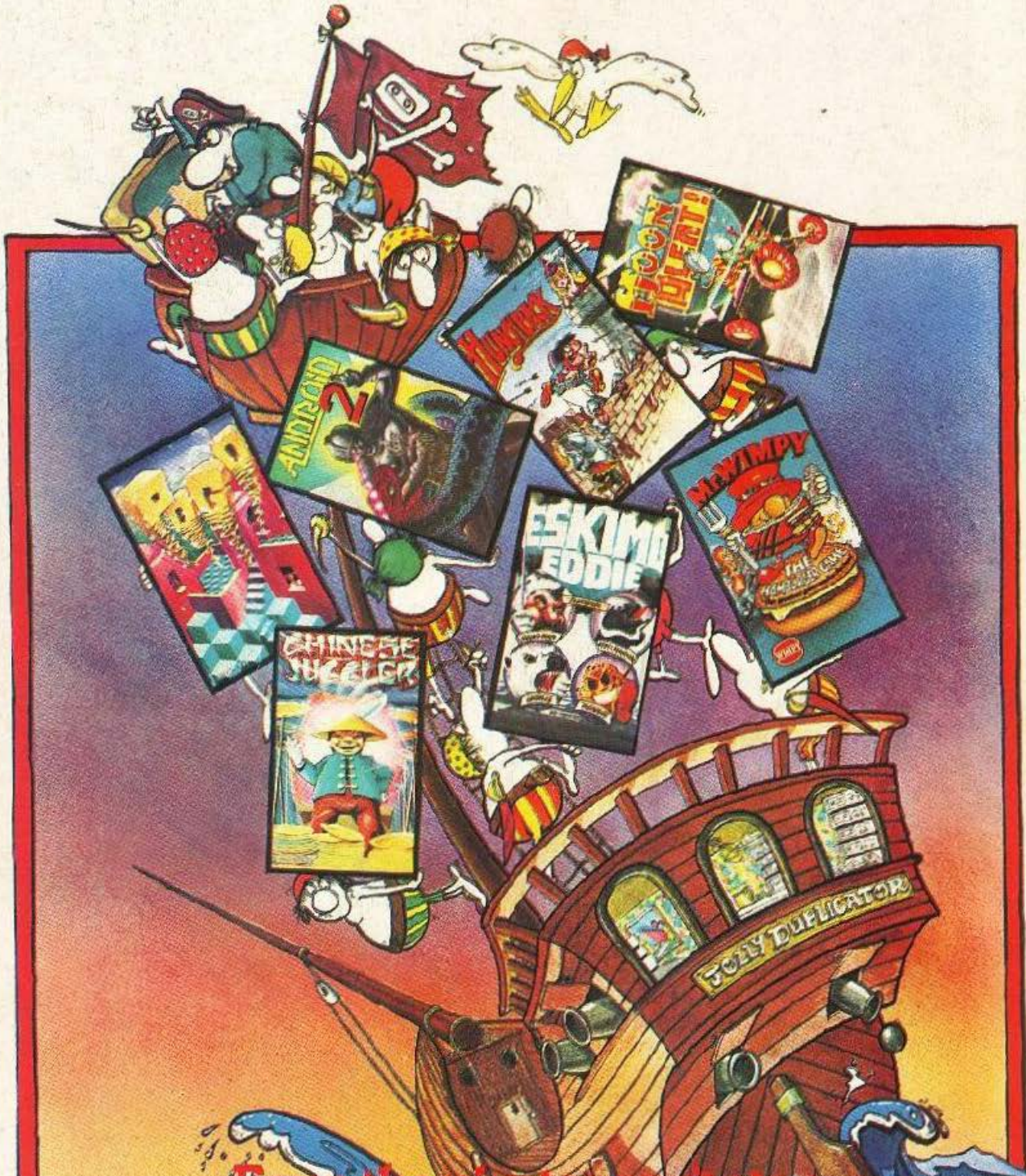

Even the pirates can't stop playing these priceless new gems from Ocean!

That's right, even the pirates will be dropping their duplicators to play **Moon Alert**, to join in the swinging fun with **Hunchback**, to attack with **Android Two**, jump for their lives with **Pogo**, spin themselves dizzy with **Chinese Juggler**, they'll just crack-up with **Eskimo Eddie's** Arctic action and there will be no stopping the captain once he gets his hook on **Mr. Wimpy** that zany burger battle. Don't you miss all the Ocean action get down to your local dealer now and join in the fun and games.

Moon Alert	Spectrum **5·90**	**Chinese Juggler**	Comm. 64 **6·90**
Hunchback	Spectrum, Comm. 64, Oric **6·90**	**Eskimo Eddie**	Spectrum **5·90**
Android Two	Commodore 64 **6·90**	**Mr. Wimpy**	Comm. 64, Oric **6·90**
Pogo	Spectrum **5·90**		Spectrum **5·90**

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Ocean Software is available from selected branches of **WOOLWORTH**, W H SMITH, **John Menzies**, **LASKYS**, **Rumbelows**, Spectrum Shops and all good software dealers. Trade enquiries phone: 061 832 7049.

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